Environmental Quality

22nd Annual Report
The Council on Environmental Quality

THE PRESIDENT'S MESSAGE

1991 IN REVIEW

AGRICULTURE

AIR QUALITY

BIODIVERSITY

BUDGET

COASTS & OCEANS

DATA COLLECTION & ANALYSIS

ECONOMICS

EDUCATION

ENERGY

ENFORCEMENT

FEDERAL FACILITIES MANAGEMENT

FISHERIES & MARINE MAMMALS

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Environmental Quality

The Twenty-Second Annual Report of the
Council on Environmental Quality together with
The President's Message to Congress

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Council on Environmental Quality
March 1992

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The President's Message on Environmental Quality

To the Congress of the United States:

In 1991 two events set the stage for a new era in history: the West won the Cold War and the United States led a U.N. coalition to roll back aggression in the Middle East. Both watershed events demonstrated the power of sustained international cooperation in pursuit of just and moral causes. They underscored the need for U.S. leadership in a complex, interdependent world.

Historic changes are also occurring in the relationship between humanity and the environment. We increasingly recognize that environmental improvement promotes peace and prosperity, while environmental degradation can cause political conflict and economic stagnation. We see that environmental protection requires international commitment and strategic American leadership in yet another just and moral cause.

Merging Economic and Environmental Goals

As I often have stated, we can have both economic growth and a cleaner, safer environment. Indeed, the two can be mutually supportive. Sound policies provide both.

My environmental strategy seeks to merge economic and environmental goals. For example, boosting two engines of economic growth—technological change and international trade—can also provide benefits for the environment. Likewise, regulatory approaches that emphasize economic efficiency can help lower the costs of securing greater environmental quality. The following examples are illustrative.

Investments in Technology

My Administration has invested aggressively in key areas of research and development that will boost productivity and economic performance. Several technologies heralded primarily for their benefit to economic growth and competitiveness, such as advanced materials, high performance computing, electric batteries, and biotechnology, also have valuable environmental applications. Increasing investments in basic environmental research will enable policymakers to devise more informed, effective, and efficient policies.

International Trade

In negotiations on the General Agreement on Tariffs and Trade (GATT), the United States calls on other nations to reduce farm subsidies, which harm competitive farm exports and contribute to environmental degradation. In parallel with negotiations toward a North American Free Trade Agreement (NAFTA), the United States and Mexico are expanding environmental cooperation. A free trade agreement would lead to stronger growth in both countries and provide increased financial resources for environmental protection.

Economically Efficient Regulations

Our Clean Air Act initiatives spur utility energy efficiency through innovative tradable sulfur emission allowances and an overall cap on emissions. Restraining electricity demand cuts emissions of carbon dioxide and acid rain precursors, lowers energy bills for homeowners and businesses, and limits the need for new powerplant construction.

The Global Environment and Development

Robust economic growth is needed to meet the needs and aspirations of the world's peoples. At the same time, the nations of the world must ensure that economic development does not place untenable burdens on the Earth's environment.

My Administration has been working with business leaders, environmentalists, scientists, and the governments of other countries to develop more effective, efficient, and comprehensive approaches to global economic and environmental issues. Preparations for the United Nations Conference on Environment and Development (UNCED or Earth Summit), which convenes this June in Rio de Janeiro, Brazil, have accelerated this process.

My priorities for this historic conference are as follows:

- *Sign a satisfactory global framework convention on climate change;*
- *Agree on initial steps leading to a global framework convention on the conservation and management of all the world's forests;*
- *Improve U.N. environmental and developmental agencies as well as the Global Environment Facility (GEF), which provides financial assistance to developing nations in meeting the costs of gaining global environmental benefits;*
- *Launch an action program to conserve biodiversity and, if possible, sign a satisfactory global framework convention on biodiversity;*
- *Agree on a strategy and expand efforts to improve the condition of oceans and seas; and*
- *Adopt a strategy and initiatives to promote technology cooperation in a free market context.*

Climate Change

On behalf of the United States, I hope to sign by June 1992 a global framework convention that will commit as many nations as possible to the timely development of comprehensive national climate action plans. Such plans would commit nations to a

process of continuous improvement, addressing sources and reservoirs of all greenhouse gases as well as adaptation measures. Parties to the convention would compare their action programs on a regular basis and revise them as necessary.

By producing specific, comprehensive environmental commitments that fit each nation's particular circumstances, this approach is preferable on environmental and economic grounds to the carbon-dioxide-only proposals that others have espoused. The United States will continue to restrain or reduce its net carbon dioxide emissions by improving energy efficiency, developing cleaner energy sources, and planting billions of trees in this decade. But an exclusive focus on targets and timetables for carbon dioxide emissions is inadequate to address the complex dynamics of climate change.

Forests and Biodiversity

The nations of the world need to do a better job of studying and conserving the diversity of life on Earth. Nations also need to work together to improve the management and protection of all the world's forests. For these reasons, I am renewing my call for a global framework convention on the management and conservation of forests and restating the U.S. hope that UNCED will be the occasion for making progress toward such a convention. I am also hopeful that a convention on the conservation of biodiversity may be signed at UNCED.

Institutional Reform and Funding

Member nations need to coordinate U.N. structures and make them more efficient and effective in meeting UNCED goals. A related priority is to continue development of the World Bank's Global Environment Facility (GEF). The GEF should become the principal vehicle for assisting developing nations with the incremental costs of gaining global environmental benefits under new international agreements.

Oceans

Coastal and estuarine areas include some of the most diverse and productive ecosystems on Earth. Increasing population and development are stressing these areas, particularly in nations that lack effective programs to protect and manage marine resources. The United States urges UNCED parties to adopt a set of principles and an action plan to address such issues as the status of living marine resources, coastal zone management, ocean monitoring, and land-based sources of marine pollution.

Technology

The UNCED participants should adopt a strategy and initiatives to promote market-based environmental technology cooperation with developing nations. In some cases, the transfer of environmentally preferable technologies results from official foreign assistance. However, in the vast majority of cases it occurs as the result of private sector activities such as direct foreign investment, joint ventures, licensing, exports, and professional training. Thus the role of governments and international institutions should be to foster the market conditions that accelerate private sector activity in the growing global market for environmental goods and services.

The Domestic Environment

In the midst of increased attention to global environmental issues, the United States in the last 3 years has enacted and begun to implement sweeping environmental reforms. We will continue to take action predicated on sound science and efficient solutions. State and local governments, businesses, community groups, and individual citizens must also play a part.

A number of items on the environmental agenda, including reauthorization of the Clean Water Act, the Resource Conservation and Recovery Act, and the Endangered Species Act, require a thorough, judicious review with an eye toward the long term. Wherever possible, such legislation should encourage economically sensible, market-based mechanisms. Quick-fix actions will not be in the best interest of the environment or of our economy.

The Congress should make a significant contribution to economic growth and the environment by taking the following steps during this session:

- *Enact balanced national energy legislation, providing equal measures of new conservation and production;*
- *As requested in my budget, provide increased funds to a number of key environmental and natural resources programs; and*
- *Establish a U.S. Department of the Environment.*

National Energy Legislation

In the year that has passed since I proposed a National Energy Strategy (NES) providing equal measures of new energy conservation and production, the Administration has moved to implement more than 90 NES initiatives that do not require legislative action. The Congress has followed through by increasing funding for an array of research and development initiatives. Now, in addition to these measures, the Congress needs to complete action on comprehensive national energy legislation.

Environmental and Natural Resources Budget

Within the context of initiatives to tighten Federal budget discipline, my proposed budget for fiscal 1993 reflects my continuing belief that we should increase national investments in key environmental and natural resources programs. Among my priorities are the following:

- $1.85 billion (a 17-percent increase over fiscal 1992) for the America the Beautiful program, including acquisition of key park, forest, refuge, and other public lands; my program to encourage public participation in the planting of one billion trees per year; a partnership with the States to create state parks and recreation facilities; and projects to improve environmental infrastructure and recreational opportunities on the public lands;
- A record $5.5 billion (a 26-percent increase over fiscal 1992) for the cleanup of Department of Energy facilities involved in nuclear weapons manufacture;
- $201 million (almost double the fiscal 1992 level) for U.S.-Mexico border region cleanup, consistent with the Environmental Action Plan I presented to the Congress last year in support of the proposed North American Free Trade Agreement;

- Almost $1 billion for energy research and development, including over $350 million for conservation research and development (more than double the fiscal 1989 level) and $162.4 million (a 47-percent increase over fiscal 1992) for transportation programs such as development of electric automotive batteries and the purchase of 5,000 alternative-fuel vehicles;
- $812 million (a 35-percent increase over fiscal 1992) for wetlands research, acquisition, restoration, and enhancement, achieving a 175-percent increase over fiscal 1989 levels;
- For the second year in a row, $340 million for accelerated construction of sewage treatment facilities in six coastal cities that currently have inadequate treatment facilities;
- $7 million (a 46-percent increase over fiscal 1992) for the designation and management of National Marine Sanctuaries;
- $229 million (a 22-percent increase over fiscal 1992) for implementation of the 1990 Clean Air Act;
- $1.75 billion (an 8-percent increase over fiscal 1992) for cleanup of Superfund toxic waste sites; and
- $1.37 billion (a 24-percent increase over fiscal 1992) for further expansion of the world's largest global climate change research program.

U.S. Department of the Environment

Considering the scope and importance of responsibilities conferred upon the Environmental Protection Agency (EPA), I announced my support in 1990 for legislative efforts to elevate EPA to Cabinet status. The Congressional leadership has responded with controversial, extraneous amendments and parliamentary delays. This legislation should not be held hostage any longer. Once again, I call on the Congress to elevate EPA to Cabinet status and make it the U.S. Department of the Environment.

A National Commitment

There is a growing commitment from all segments of society to improve the environment. A key element of my environmental strategy is encouraging private companies and organizations to work with each other and with government to deliver conservation benefits that go far beyond what government acting alone could provide.

In July 1991 I named leaders of business, environmental, recreational, educational, and philanthropic organizations to serve as members of the President's Commission on Environmental Quality (PCEQ). I have challenged this Commission to develop and implement an action agenda to improve the environment through voluntary private sector activities that meet the test of economic efficiency.

I also established a Presidential medal for environment and conservation achievement and had the honor of presenting medals to an outstanding group of Americans last October. This program rewards private initiative in service to the environment in a manner equivalent to long-standing Presidential recognition of excellence in the arts, humanities, sciences, and world affairs.

We have encouraged additional private sector initiatives through such groundbreaking efforts as the "Green Lights" energy efficiency project, the "33-50" toxic

emission reduction program, the U.S. Advanced Battery Consortium to support development of electric vehicles, and land management partnerships between conservation groups and the departments of Defense, Agriculture, and the Interior.

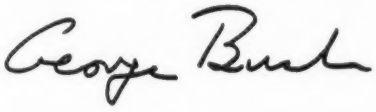
Freedom's Full Meaning

As more people around the world join the democratic family and reach for their God-given rights and aspirations, we Americans who have led the way for over 200 years will continue to bear a responsibility to give freedom its full meaning, including freedom from want and freedom from an unsafe environment.

The Cold War was a stark test of the global community's faith in these ideals. We passed that test.

The deadlock in negotiations for improved international trade rules is another challenge to the principles that have drawn the world closer together in the last half century. We must not fail that test.

These struggles for national security and economic growth are now joined by environmental concerns such as deforestation and potential climate change, which also have profound long-term implications. The year ahead will test our ability to redefine the relationship between humanity and the environment—and in so doing, to secure a greater peace and prosperity for generations to come. We must not fail that test.



George Bush

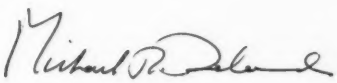
EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, DC 20500

Letter of Transmittal

The President:

Sir: The Council on Environmental Quality herewith submits its Environmental Quality Report for the year 1991 in accordance with section 201 of the National Environmental Policy Act of 1969 (42 U.S.C. 4341).

Sincerely,



Michael R. Deland
Chairman

From the Chairman: 1991 in Review

It shall be the duty and function of the Council...to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation...
National Environmental Policy Act, section 204(4)

Each year, when the Council on Environmental Quality prepares the President's annual report to the Congress on the environment, the important issues and questions are the same: Are conditions in the environment getting better or worse? Will future generations benefit from the same bounty of forest, field, and stream that we do? As we develop our economy, are we doing enough as individuals and as a nation to ensure a safer, cleaner home for ourselves and our neighbors on the planet?

There are no simple answers to these questions. A number of indicators are positive, while others are disturbing. But as the early environmentalist John Muir wrote, "When we try to pick out anything by itself, we find it hitched to everything else in the universe." Efforts to protect and improve the environment will continue as long as humans feel compelled to leave a better quality of life for future generations.

Environmental Conditions and Trends in 1991

While environmental conditions are a complex subject, a broad review of 1991 developments reveals the following trends:

Air and Water Quality

Air quality is better in most U.S. cities compared to conditions in the 1960s, but air pollution has increased in some suburban and rural areas. Likewise, water quality is improving in the majority of U.S. lakes, rivers, and streams, and most communities today have adequate wastewater treatment. But rapid growth in U.S. coastal areas since 1960 has led to widespread losses of wildlife habitat, reduced catches of fish and shellfish, and localized water quality degradation. The coastal cities of New York, Los Angeles, Boston, San Diego, Baltimore, and Seattle still do not have adequate sewage treatment.

"Nonpoint" sources of pollution such as runoff from farms and cities are a stubborn, continuing problem.

Land Management

Our society is slowly making improvements in the way we accommodate multiple land-use demands such as urban development, recreation, agriculture and resource development, and wilderness and wildlife habitat. A growing number of major landowners conduct their activities in a context of maintaining functional ecosystems using techniques as varied as computer mapping and help from citizen volunteers. Even so, the nation is also grappling with perennial questions involving energy development, proposed restrictions affecting special ecosystems like old-growth forests and wetlands, and the handling of industrial and community wastes.

Environmental Headlines, 1991

Major environmental and natural resources developments of 1991 are reflected in this sampling of headlines:

January	Iraq's Saddam Hussein orders a massive crude oil release into Persian Gulf; smoke and acid rain rise from burning oil wells.
	California imposes most stringent water use restrictions yet in battle with a 5-year drought.
February	President's National Energy Strategy calls for equal measures of new energy conservation and production.
	The United States hosts opening session of U.N.-sponsored negotiations toward a global climate treaty.
April	Environmental problems addressed in free trade negotiations between the United States and Mexico.
	President Bush orders federal agencies to cut energy use in buildings and motor vehicle fleets.
May	Federal judge orders logging halt on certain federal lands to protect the spotted owl, a threatened species.
July	President Bush asks 25 environmental and business leaders to develop a private sector voluntary action agenda to improve the environment.
	Chicago Board of Trade votes to create a market for sulfur dioxide permits created by 1990 Clean Air Act.

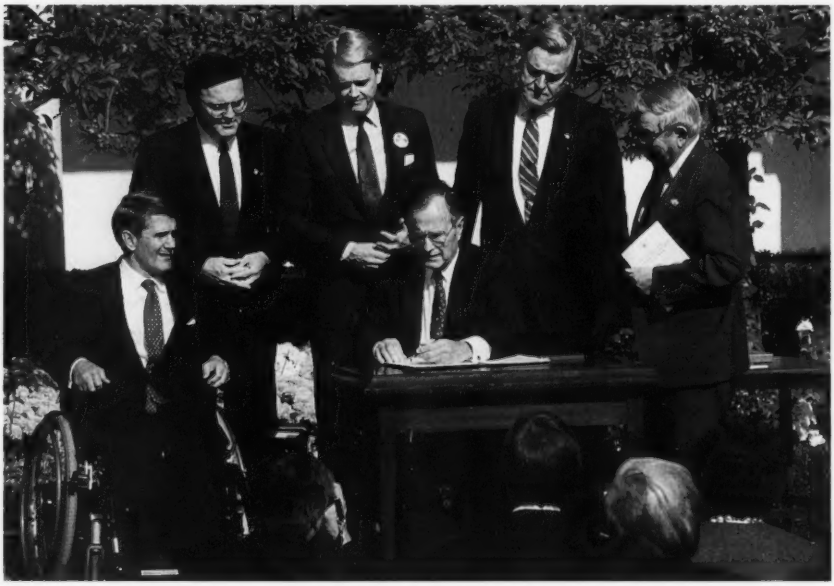
International Challenges

The past year witnessed landmark decisions in the protection of our planet, with none so dramatic as President Bush's action to begin to deactivate and destroy hundreds of nuclear weapons. His actions go far beyond the requirements of existing treaties, and they have elicited comparable pledges of arms reduction from the leaders of the Commonwealth of Independent States. These activities will require strict verification and environmental safeguards; in his fiscal 1993 budget, the President has asked for another major funding increase to clean up contaminated weapons production facilities in the United States. But at last world leaders have lessened dramatically the greatest environmental threat of the modern age—nuclear war.

Also during 1991 the United States signed an international accord to strengthen environmental protection in

Environmental Headlines, (continued).

August	President Bush proposes plan to streamline regulations and move toward his goal of no net loss of wetlands.
	Federal health authorities determine the potential risks of dioxin have been overstated.
	Toxic herbicide spill pollutes 45 miles of Sacramento River and Lake Shasta in California.
October	Federal Government lowers threshold of blood lead levels considered acceptable in children.
	Clearer vistas over Grand Canyon will result from negotiated emission reductions from powerplant.
	President Bush orders federal agencies to step up recycling and waste reduction efforts.
	Justice Department, State of Alaska, and Exxon reach settlement of claims resulting from 1989 *Exxon Valdez* spill; penalties total over $1 billion.
November	Japan agrees to end driftnet fishing on high seas, paving the way for a worldwide moratorium.
December	Pacific gray whale removed from endangered species list following conservation efforts.



J.H. Bailey, National Geographic Society.

President Bush signs Executive Order on Federal Recycling and Procurement, as Administration officials look on: (left to right) CEQ Chairman Michael R. Deland, GSA Administrator Richard G. Austin, EPA Administrator William K. Reilly, Secretary of Energy James D. Watkins, and Secretary of the Interior Manuel Lujan, Jr.

Antarctica, including an indefinite prohibition on mineral exploration and development. Through the United Nations, representatives of many nations worked on developing a common agenda to fight such problems as ozone layer depletion, deforestation, and potential global warming.

Sadly, 1991 also witnessed the most heinous acts of environmental terrorism in history. As part of an unprovoked campaign of aggression toward Kuwait and neighboring countries, Iraq's Saddam Hussein ordered the release into the Persian Gulf of between six and eight million barrels of crude oil, up to 30 times more oil than was spilled in the 1989 *Exxon Valdez* incident. Iraqi forces also torched or damaged over 700 oil wells. Personnel from more than 15 United States Government agencies joined in an international response effort, but it will take years of continued effort to assess and repair the damage.

The President's Strategy for Environmental Quality

The President's Strategy for Environmental Quality, described in detail in last year's CEQ annual report, addresses domestic and international concerns, public and private sector roles, and immediate and long-term needs. The strategy is based on six broad principles that have characterized Administration policies and programs:

- Harnessing the power of the marketplace,
- Managing natural resources as responsible stewards,
- Promoting creative partnerships,

Bush Administration
Environmental Accomplishments and Initiatives

The Bush Administration has expanded efforts to protect and improve the environment, both domestically and internationally. Highlights of that record illustrate the President's agenda:

- Proposed, enacted, and began implementing the world's most protective clean air law. Increased the EPA operating budget 47 percent over 1989 levels.
- Declared a moratorium on offshore oil and gas development off most of the West Coast, Southern Florida, and New England.
- Added over $750 million in funding for expansion and improvement of our national parks, forests, and public lands.
- Set enforcement records; EPA collected more civil penalties in 2 years than in its entire history.
- Accelerated the U.S. phaseout of CFCs to the end of 1995, 4 years ahead of international deadlines.
- Called for a global climate treaty to be signed by world leaders at the June 1992 U.N. conference in Brazil. Devoted nearly $2.6 billion to global climate change research from 1990 to 1992, by far the largest contribution of any nation.
- Supported innovative environmental efforts in Latin America, the Caribbean, Eastern Europe, and the Far East.
- Boosted national and international efforts to prevent and respond to oil spills.
- Launched a program to encourage citizen participation in the planting of one billion trees per year across America.
- Increased funding for the study, protection, and enhancement of wetlands from $295 million in 1989 to $600 million in 1992.
- Led the way to an international ban on driftnet fishing and trade in African elephant ivory.
- Improved environmental education through the National Environmental Education Act of 1990 and other programs.
- Signed executive orders to boost recycling, waste reduction, and energy efficiency at all federal agencies.
- Tripled funding to clean up federal facilities and bring them into compliance with environmental laws.

- Developing cooperative international solutions,
- Preventing pollution before it starts, and
- Enforcing environmental laws firmly and fairly.

For example, the President's Clean Air Act initiatives and National Energy Strategy seek to harness market forces to accomplish environmental and economic benefits at the least cost. The Administration has increased federal funding for natural resources stewardship programs and has set new records and precedents in environmental law enforcement. Federal agencies have cultivated private sector partnerships, and a new Presidential medal recognizes outstanding private initiatives. Pollution prevention has become the cornerstone of programs sponsored by the Environmental Protection Agency, the Department of Defense, and the Department of Energy. In the international arena, the Administration has fostered innovative, problem-solving programs such as the East European Environmental Center in Budapest, the U.S.-Asia Environmental Partnership, and the Enterprise for the Americas Initiative environmental trust funds.

CEQ Year in Review

In 1991, working closely with federal colleagues, the interdisciplinary CEQ team helped prepare Presidential environmental statements, executive orders, and decision memoranda, and assisted in the development of Administration positions in legislative, regulatory, and diplomatic matters. Among our priority issues were the following:

Biodiversity

With the assistance of EPA, the Department of Defense, and the Fish and Wildlife Service, CEQ planned a series of workshops on consideration of biodiversity and ecosystem management as part of analyses for NEPA environmental impact statements.

Responding to declines in populations of salmon in the Pacific Northwest and their possible listing as endangered species, CEQ staff participated with federal, state, and private interests in discussions that came to be known as the "Salmon Summit." CEQ legal staff advised federal agencies on achieving NEPA compliance for decisions reached at these meetings.

Data Collection and Analysis

The Council reports on trends in the environment as required by the National Environmental Policy Act (NEPA). A 1989 CEQ publication, *Environmental Trends*, received a Notable Documents Award in 1991 from the American Library Association.

In the last year, CEQ has renewed its emphasis on strategic planning to coordinate activities of the many federal agencies involved in environmental data collection. Our goal is to ensure that consistent, reliable information is available in a usable form to environmental policymakers. In 1991 the Council reactivated the Interagency Committee on Environmental Trends (ICET), which had helped CEQ produce earlier trends reports. ICET will coordinate the environmental information activities of numerous federal agencies.

NEPA Compliance

CEQ oversees federal compliance with the National Environmental Policy Act, including the environmental impact

assessment process. During the past year, CEQ emphasized the importance of integrating other federal, state, and local environmental review requirements into the NEPA process and incorporating NEPA substantive goals into the agency decision. A compliance workshop examined NEPA integration in the context of transportation, natural resources, private development, and energy projects. CEQ leads an interagency policy review group to improve implementation of Executive Order 12114, which provides the policies and procedures for assessing the environmental effects of major federal actions abroad. In addition, the Council helped develop the Convention on Environmental Impact Assessment in a Transboundary Context signed in 1991 by the United States and other members of the Economic Commission for Europe (ECE).

National Acid Precipitation Assessment Program (NAPAP)

CEQ chairs the Interagency Task Force on Acid Precipitation, reauthorized in the Clean Air Act Amendments of 1990 and charged with developing a new plan for the National Acid Precipitation Assessment Program. NAPAP is a mechanism through which federal agencies cooperate to advance research and assessment goals on issues relating to acid rain. In November 1991 NAPAP released a draft program plan for public review.

Pollution Prevention

Using the economic and engineering expertise on its staff, CEQ helped develop pollution prevention strategies for government and the private sector. The Council helped develop the EPA National Pollution Prevention Strategy and executive orders that set energy efficiency, recycling, and procurement requirements for the federal government.

President's Commission on Environmental Quality (PCEQ)

In 1991, as directed by Executive Order 12737, CEQ launched the President's Commission on Environmental Quality. Comprised of business, environmental, academic, and philanthropic leaders and chaired by CEQ, the Commission is implementing an action agenda for voluntary initiatives to achieve concrete benefits in the areas of pollution prevention, energy efficiency, natural resources stewardship, international cooperation, and education and communications. The Commission plans to launch PCEQ projects in the second quarter of 1992.

Presidential Medals for Environment and Conservation

In 1991 President Bush bestowed the first Presidential medals for outstanding achievement in the fields of environmental quality management, partnerships, innovation, and education and communications. CEQ assisted an independent selection committee and managed the program. Award recipients are profiled in the Private Sector Initiatives section of this report.

U.N. Conference on Environment and Development (UNCED)

CEQ was represented on the U.S. delegation to UNCED Preparatory Committee meetings and, in this capacity, continued to work closely with the State Department and other agencies to prepare for the conference. CEQ coordinated the preparation of the U.S. National Report to UNCED, which

describes domestic environmental trends and policies since 1972, when the U.N. Conference on the Human Environment was held in Stockholm, Sweden. To gather public input for the report, CEQ organized roundtable discussions in San Francisco, Boulder, Chicago, and Baltimore.

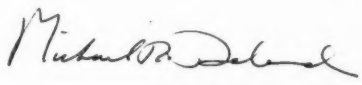
Wetlands, Coasts, and Clean Water

As a member of the Domestic Policy Council Task Force on Wetlands, CEQ assisted in the development of the President's comprehensive plan for the protection of wetlands, which was released in August 1991. The plan is designed to move the nation toward the President's goal of no net loss of wetlands. The Council will continue to participate in interagency committees to develop implementation plans. CEQ participated in discussions within the Administration and with the Congress regarding reauthorization of the Clean Water Act, emphasizing economic incentives and priority concerns such as coastal degradation.

In 1991 CEQ coordinated the Coastal America initiative involving the National Oceanic and Atmospheric Administration (NOAA), the Army Corps of Engineers, the Environmental Protection Agency , the Department of the Interior, as well as state and local governments and the private sector. This partnership addresses such coastal problems as habitat degradation, nonpoint source pollution, and sediment contamination. It encourages development of site-specific, action-oriented projects along with national education and evaluation efforts.

Nature's Advocates

As President Bush reminds us, "We can and should be nature's advocate." That is a charge taken seriously by his dedicated team at CEQ. We are ever mindful of our responsibility under NEPA to serve as a trustee of the environment for generations to come. Working closely with concerned citizens and government leaders, we are committed, on behalf of the President, to leave a cleaner, safer world and a better quality of life than those we inherited. Through trial, evaluation, correction, and persistence, we will succeed.



Michael R. Deland

PART I: Environmental Issues and Policies

Agriculture

[Relate] local short-term uses of man's environment and the maintenance and enhancement of long-term productivity...
National Environmental Policy Act, section 102(C)(iv)

Also see Forestry, Wetlands, and related tables and figures in Part II.

In the past, agricultural production and conservation goals sometimes worked at cross purposes. Today, however, most federal farm program benefits—commodity price supports, loans, and crop insurance—are contingent on the application of land stewardship practices. Current federal strategies to regulate agricultural chemicals are designed to prevent unreasonable adverse effects on human health and the environment. Recent farm legislation established tree-planting programs and laid the groundwork for a long-term transition to environmentally preferable farm practices.

Conditions and Trends

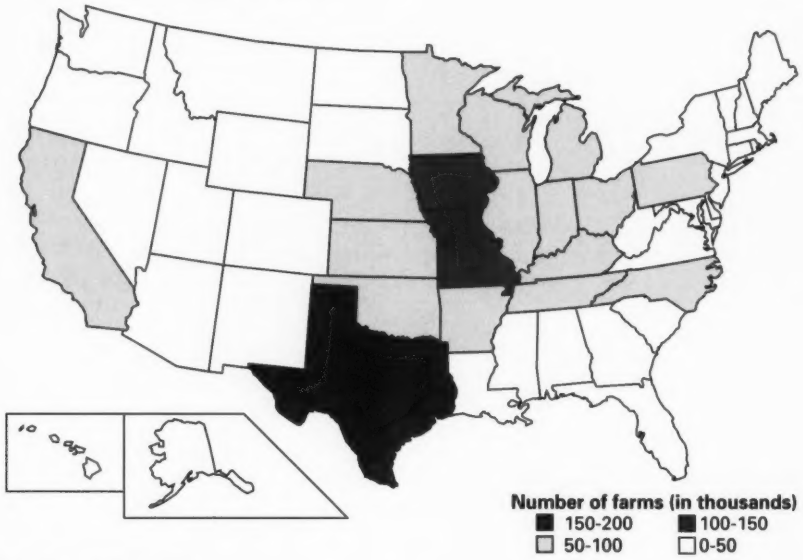
U.S. agriculture has the capability to supply both the domestic and international market with food, now and in the future, but not without limits. One of

Goals of U.S. Agriculture

The agricultural policy of the United States is based on the following objectives:

- **Ensuring consumers safe and abundant food and fiber at the lowest possible prices,**
- **Maintaining the competitiveness of American producers in world markets,**
- **Conserving the nation's natural resources, in part by creating partnerships between agricultural production and conservation interests in and out of government.**

Number of U.S. farms, by state.



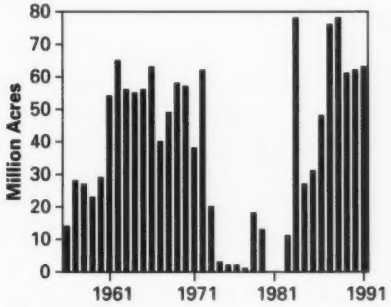
Note: Data is for 1987.
Source: U.S. Department of Commerce, Bureau of the Census, *Census of Agriculture: 1987*, (Washington, DC: DOC, 1988), Volume 1.

the most visible limits is the loss of soil used for crop production. In 1987, the latest year for which Department of Agriculture figures are available, U.S. farmers protected only 195 million acres against erosion out of 421 million acres devoted to crop production. Although farm distribution has not changed markedly, total farmland area is decreasing as the result of a combination of factors, including farm production technologies that reduce labor requirements, consolidation of small farms into larger operating units, government-sponsored land retirement programs, and conversion of farmland to nonfarm use.

The trend continues toward fewer, larger farms. The amount of land in farms of 1,000 acres or more has increased, whereas land in farms of 500 acres or less has declined. The nation is not only losing farms, it is losing prime farmland—those acres that produce the highest yields with minimal expenditure of energy and economic resources and with least damage to the environment. Loss of prime farmland puts more pressure on the use of less suitable farmland that is more difficult to cultivate, usually less productive, and more susceptible to erosion and drought. Although conversions of pasture, forests, and wetlands are adding new cropland acres, these gains are being offset by losses to urban areas and other nonfarm uses.

Chemicals are among the principal inputs to agriculture. Fertilizers based on primary nutrients such as nitrogen, phosphorus, and potash can increase yields per acre even on eroded soils, but they also can accumulate in the environment at levels that adversely affect surface water and groundwater. Fertilizer

Cropland diverted from production under federal programs.



Source: See Part II, Table 48.

use in the United States is down from its peak in the 1970s as the result of adjustments in the farm economy. In 1991 agricultural pesticide use showed a slight increase, reflecting the dependency of farmers on the use of these chemicals. Environmental concerns relate to the ability of pesticides to harm nontarget species, foster development of resistant pests, and accumulate in food chains. Pesticides enter the atmosphere from spray during application and reach the aquatic environment in sediment runoff, in effluent from manufacturing plants, and through bioaccumulation.

Policies and Programs

The conservation title of the 1985 Farm Bill changed the priorities of federal soil and water conservation agencies, of their state and local cooperators, and of farmers themselves. The Food, Agriculture, Conservation, and Trade Act of 1990 (1990 Farm Bill) strengthened the 1985 provisions and, for the first time, included a forestry title implementing the President's national tree-planting initiative. It also provided farmers with incentives to prevent pollution through long-term adoption of alternative farming methods, such as low-input sustainable agriculture (LISA). Taken together, these provisions help protect the environment by creating incentives to reduce soil erosion on agricultural lands, enhance wildlife habitat, conserve wetlands, and improve water quality.

In 1991 the Environmental Protection Agency (EPA) issued a strategy describing federal policies and regulatory approaches to protect the nation's groundwater resources from risks of contamination by agricultural chemicals.

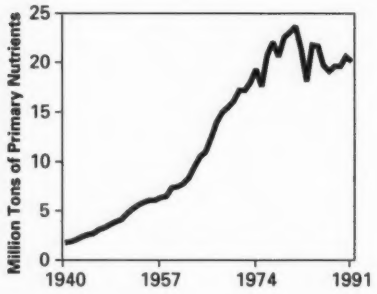
Within the U.S. Department of Agriculture, the agencies chiefly responsible for implementing conservation provisions and environmental regulations are the Agricultural Stabilization and Conservation Service, Soil Conservation Service, Farmers Home Administration, Agricultural Research Service, Federal Crop Insurance Corporation, and Cooperative Extension Service. A summary of initiatives follows.

Conservation Compliance

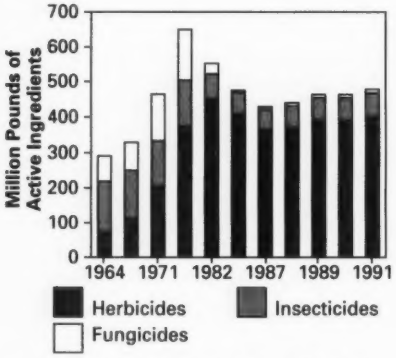
To remain eligible for USDA farm program benefits, farmers must develop and carry out approved conservation plans on highly erodible cropland. To date, the Soil Conservation Service has helped 1.3 million farmers develop conservation plans to protect 135 million acres of land. The plans include 215,000 miles of terraces, 1.3 million acres of grassed waterways, 4,700 miles of diversions, 25 million acres of contour farming, and more than 100 million acres of conservation tillage. In fiscal 1991 farmers implemented 52 percent of their conservation plans, mostly by enrolling highly erodible land in the Conservation Reserve Program (CRP), which temporarily removes such crop-

Agricultural chemicals.

Fertilizer use.



Pesticide use.



Source: See Part II, Table 53 and Table 54.

land from production. The deadline for complete implementation of the plans is 1995.

Conservation compliance protects highly erodible land used for crop production as well as land set aside under commodity and conservation programs. To facilitate compliance, the 1990 Farm Bill introduced a system of graduated penalties, ranging from $500 to $5,000 depending on the severity of the violation of a conservation plan. Previously violations, regardless of severity, resulted in complete denial of all federal farm program benefits.

Conservation Reserve Program

The Conservation Reserve Program offers producers an incentive to voluntarily remove highly erodible cropland and other environmentally sensitive land from production for at least ten years. Farmers who enroll in the program receive an annual rental payment for idling the land and cost-share help in establishing a cover of grass or trees.

As of October 1, 1991, farmers had enrolled 35.6 million acres in the program, resulting in numerous environmental benefits. Average soil loss on CRP lands has declined to one-tenth of the former rate, from 22 to 2 tons per acre per year. Farmers are planting more than 2 million acres in trees; 8 million acres are in grass, predominantly in the prairie and Great Plains region; and another 1.9 million acres are in plantings particularly hospitable to wildlife. In 1989 some 410,000 acres of wetlands entered the program. In the prairie pothole region of North and South Dakota, during one sign-up period alone, the program enrolled 150,000 acres of wetlands. Under a program option, 12,000 acres of shallow-water wetlands will be restored. Eligibility now extends to saline lands and to cropland that contributes to water quality degradation. Incentives encourage the planting of hardwood trees in woodlands, windbreaks, shelterbelts, and wildlife areas. Key watersheds, such as the Chesapeake Bay and the Great Lakes, are designated as Conservation Priority Areas and, as such, receive preference in program enrollments.

In addition to reducing soil erosion, CRP reduces herbicide and pesticide usage by an estimated 30,000 tons annually and fertilizer use by 2.4 million tons annually. Reduced use of agricultural chemicals and nutrients on

the nation's most erodible soils will have a positive impact on water quality and associated aquatic systems, although specific water quality benefits are difficult to quantify at present.

Swampbuster

The Swampbuster provision of the 1985 Farm Bill protected the environmental values of wetlands—including wildlife habitat, flood control, filtering of nutrients and toxics, and groundwater recharge—by disqualifying from farm program benefits producers who plant crops on newly converted wetlands. The 1990 Farm Bill extended the provision to apply when wetlands are drained, dredged, filled, leveled, or otherwise altered to allow crop production.

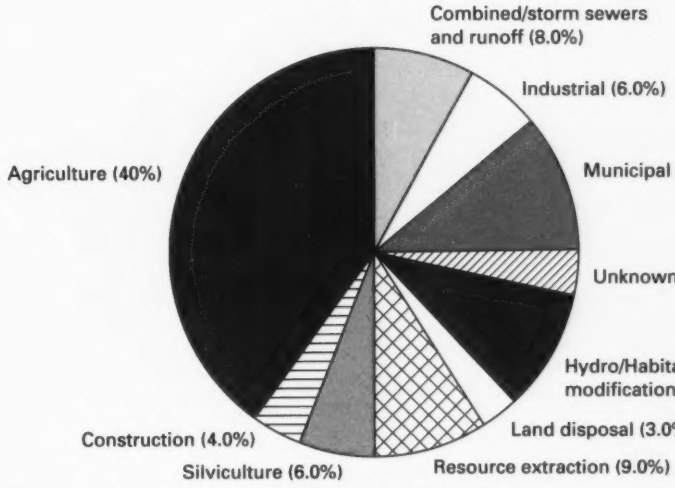
Sodbuster

The Sodbuster provision discourages conversion of grasslands and forests to crop production by requiring

Wetlands Reserves

The 1990 Farm Bill created a voluntary easement program with financial incentives for landowners who grant easements of at least 30 years to maintain or restore wetlands. The Wetlands Reserve Program offers technical aid and cost-share assistance to develop and carry out wetlands restoration plans. Farmed wetlands and farmland converted from wetlands are eligible, with priority given to those areas promising the greatest potential wetlands benefits upon restoration. In fiscal 1992, with $46 million appropriated to enroll 50,000 acres, the Wetlands Reserve Program will begin as a pilot program in several states.

Sources of pollution in U.S. rivers.



Note: Based on river miles monitored in 1990, which represent 9.5 percent of total U.S. river miles.
Source: See Part II, Table 31.

the use of conservation measures on all such converted land. The Super Sodbuster amendment of the 1990 Farm Bill prohibits CRP participants from bringing newly purchased highly erodible land into crop production.

Agricultural Water Quality

The Agricultural Water Quality Incentives Program provides payments and technical assistance to landowners who reduce the movement of nonpoint source contaminants to surface and subsurface waters. A program option encourages improvements to wildlife and wetlands habitat. Funding for fiscal 1992 is $6.7 million, with the focus on priority water quality areas.

The Presidential Water Quality Initiative includes demonstration projects to extend agricultural water treatment practices. The initiative assesses and reports on progress in treating water quality problems such as those caused by identified nonpoint sources of pollution.

Pesticides and Groundwater Strategy

"Pesticides and Ground-Water Strategy," released by the Environmental Protection Agency in 1991, includes the following federal policies:

- Encourage adoption where appropriate of less environmentally burdensome agricultural practices to reduce the general risk of groundwater contamination;
- Determine the appropriate regulatory approach under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for individual chemicals that may threaten groundwater, resorting to cancellation of pesticides where EPA determines that the pesticides pose unreasonable risks and state management measures do not reduce risks to human health and the environment;
- Confine the legal sale and use of pesticides cancelled under FIFRA because of groundwater concerns to states with EPA-approved State Management Plans.
- Provide research and technical assistance supported by EPA, the Department of Agriculture, and the U.S. Geological Survey to assess groundwater problems, delineate valuable and vulnerable groundwaters, and choose management measures;
- Provide clear instructions for field use of pesticides by improving training and certification programs that increase awareness of groundwater issues and protective measures;
- Promote product stewardship, which encourages registrants to conduct more monitoring studies, develop safer alternative pesticides, and inform distributors and applicators on managing products to prevent the degradation of groundwater.

Pesticide Recordkeeping

Private users of restricted-use pesticides now will be required to maintain records comparable to those required by many states for commercial applicators. In states with no such requirement, users must maintain records on product name, amount applied, approximate date of application, and location of application. While protecting the identity of private pesticide users, USDA personnel will enter the information in a national database for statistical analysis.

Integrated Farm Management

The Integrated Farm Management Program helps producers adopt multiyear, site-specific farm management plans that use soil-conserving crops and rotations. The goals are to sustain farm productivity and profitability, prevent soil erosion, improve soil condition, and protect water quality.

The 1990 Farm Bill supports source-reduction research, nutrient management, and evaluation of agricultural nonpoint pollution. Federally supported studies of integrated crop management indicate that crop rotation may offer benefits over monoculture practices. Rotations tend to reduce fertilizer nitrogen inputs and associated nitrate-nitrogen leaching potential on some soils, but they also increase the complexity of crop management decisions. Adjacent farm systems in Iowa—one using synthetic agricultural chemicals and the other relying heavily on crop rotations and organic sources of nutrients—showed nearly equal crop yields and concentrations of nitrates at lower depths of the soil profile. Sus-

American Farmland Trust.

Missouri farmers evaluate the effects of reduced fertilizer use as part of a sustainable agriculture demonstration project.

tainable agriculture may be most economically feasible in enterprises such as livestock farms where wastes can be utilized as fertilizer for feed crops. Research on the fate and transport of chemicals, nutrients, and animal waste reveals that grasses are four times as efficient as legumes at recycling excess nitrogen fertilizer and that cereal rye and rye grass are the best cover crops for using up fall residual nitrate.

Best Management Practices studies in Georgia indicate that no-till does not increase nitrate leaching in grain sorghum/winter wheat cropping systems. The increased biological activity in no-till fields also results in faster breakdown of pesticides that would otherwise be leached into the groundwater. Research on alternative methods of pest control indicates that timely, targeted treatment of problems using less chemicals can be as effective as preventive broadcast applications of pesticides. Cover crops can be used to attract beneficial insects that are natural enemies of crop-destroying insects.

Simple but effective improvements in storing and handling potential contaminants include bulk sales to reduce the number of containers requiring disposal. Scientists also continue to develop high-yield systems that potentially limit the amount of land required for crops and make more land available for timber, wetlands, and wildlife.

Air Quality

Promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man...
National Environmental Policy Act, section 2

Also see Energy, International Issues, Transportation, and related tables and figures in Part II.

As a world leader in reducing air pollutant emissions through advanced technologies and policies, the United States is spending approximately $32 billion annually to meet the goals of the Clean Air Act. Where man-made air pollutants continue to threaten the environment and human health, the nation is moving to reduce these risks in a cost-effective manner.

Conditions and Trends

The U.S. record on reducing air pollution is remarkable because it has paralleled rising population and economic output. Nevertheless over 100 urban areas in the United States have yet to meet national health standards for at least one of the six "criteria" pollutants for which health-based federal standards exist.

Urban Air Quality

Motor vehicles account for about half of the hydrocarbon and nitrogen oxide emissions that combine to create smog in U.S. cities; they emit up to 90 percent of the carbon monoxide, and more than half of the toxic air pollutants—all despite the most stringent motor vehicle emissions control program in the world. Even though per-vehicle emissions have fallen more than 90 percent in the past 20 years, these gains have been offset by increased numbers of vehicles on the road. Since 1970 vehicle miles traveled have doubled; Americans currently travel over 2 trillion miles per year.

Acid Rain

In 1988, the year for which the most recent data are available, total national annual emissions of sulfur dioxides (SO_2) and nitrogen oxides (NO_x) were 20.9 million metric tons and 18.0 million metric tons, respectively. These emissions react in the atmosphere to form acidic particles called sulfates and nitrates, which can be deposited near the emissions source or hundreds of miles away. They can fall to the earth in dry form or be washed out of

Air Pollution Decreasing Nationally

Between 1975 and 1989 the United States reduced ambient levels of the following six key air pollutants —"criteria" pollutants for which the federal government has established health-based air quality standards:

Pollutant	Reduction %
Lead	93
Carbon monoxide	47
Ozone	14
Particulate matter	20
Nitrogen oxide	17
Sulfur dioxide	46

Source: See Part II, Table 38.

the atmosphere in rain or snow, commonly called acid rain. The federal interagency National Acid Precipitation Assessment Program (NAPAP) reported in 1991 that, while acid rain is not a problem of crisis proportions, it does contribute in varying degrees to the acidification of lakes and streams in certain regions, forest damage at high elevations, erosion of historic monuments and building materials, and visibility degradation in many areas of the country. Acid deposition is greatest in sections of Ohio, West Virginia, Pennsylvania, New York, New Jersey, Maryland, and Ontario. Scientists also suspect that acidic air pollutants may cause respiratory problems among sensitive populations.

Ozone Layer

In the upper atmosphere, chlorine concentrations resulting from human activity have increased to a level that is damaging the ozone layer, which protects the earth from harmful doses of the sun's ultraviolet radiation. Recently published scientific evidence suggests that ozone depletion over the last decade is more than twice what previous studies projected. Thinning of the ozone layer has been detected over the polar regions and in the northern mid-latitudes. While evidence is currently unavailable to suggest that ground-level ultraviolet radiation is escalating, increased exposure could lead to greater incidence of skin cancer, cataracts, and ecological damage.

Indoor Air Pollution

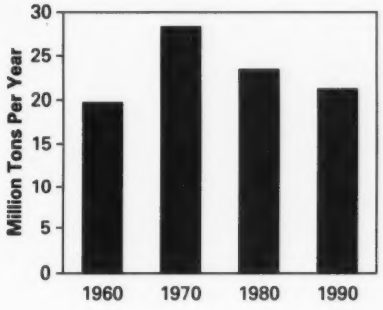
In addition to the risks of outdoor air pollution, a growing body of scientific evidence indicates that the air within homes and buildings can be as polluted as outdoor air. Most people spend over 90 percent of their time indoors, and therefore, for some contaminants, exposure to indoor air can pose a greater health threat than outdoor air exposures. Among the pollutants in indoor air is radon, a naturally occurring, invisible, and odorless gas that could be a leading cause of lung cancer in the United States. Although national and state surveys have found elevated radon levels in some areas of every state, only 6 percent of U.S. homes have been tested.

Policies and Programs

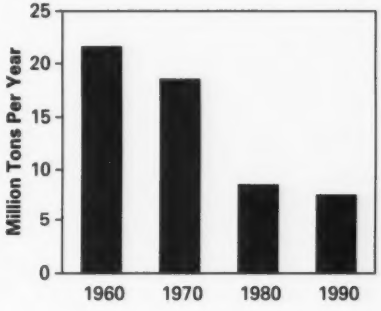
In 1990 Congress passed and President Bush approved sweeping amendments to the Clean Air Act (CAA)—the centerpiece of the nation's efforts to clean the air. Other current federal efforts include international agreements and programs that address indoor air pollution.

U.S. air pollution trends.

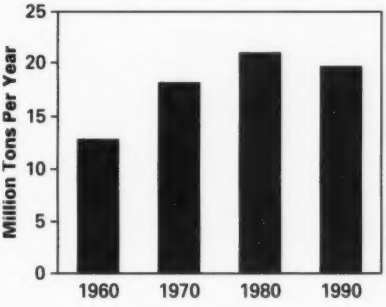
Sulfur dioxide emissions



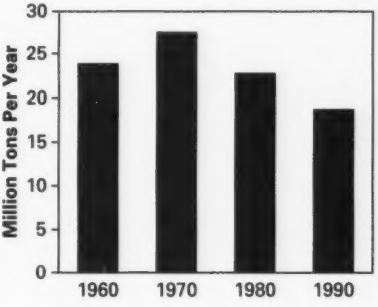
Total suspended particulates



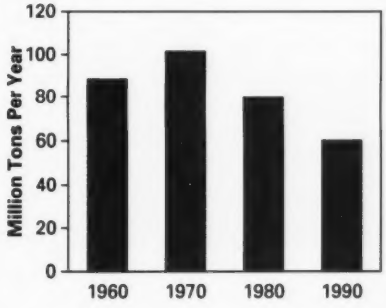
Nitrogen oxides emissions



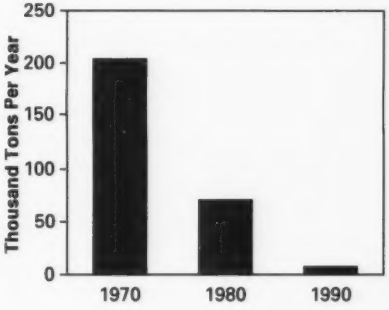
Volatile organic compounds



Carbon monoxide emissions

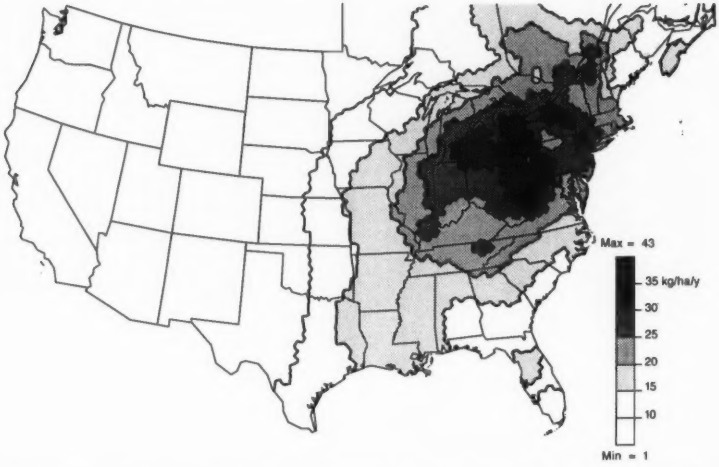


Lead emissions



Source: See Part II, Table 37.

Wet sulfate deposition in the eastern United States.



Note: Data is for 1985-1987; kg/ha/y=kilograms/hectare/year. Sulfate inputs in the western United States are less than 10 kg/ha/y. Deposition includes particulate and gaseous matter plus precipitation (water in the form of rain, snow, or fog). Acidic deposition includes all forms of acidic inputs, including sulfate ions.
Source: National Acidic Precipitation Program, *NAPAP Integrated Assessment Report,* (Washington, DC: NAPAP, 1991.)

Clean Air Act

When fully implemented, new CAA provisions will reduce air pollutant emissions by 56 billion pounds annually, roughly 224 pounds of pollutants for every man, woman, and child in this country. Provisions, to take effect in the early- and mid-1990s, require the Environmental Protection Agency (EPA) to develop over 50 detailed regulations by the end of 1992 alone. However, in contrast to earlier assaults on air pollution, the 1990 amendments allow greater flexibility in implementation and increased use of efficient, market-based solutions.

Different sections of the Act address different parts of the air pollution problem.

National Air Quality Standards (Title I). The CAA amendments specify that areas be classified according to their air quality. During 1991 EPA worked with state governments to reclassify and establish boundaries for areas that have not yet met the national ambient air quality standards. This is the first step in the development of State Implementation Plans (SIPs) that contain the actions necessary to bring areas into attainment. EPA has taken other steps to aid states in the development of new SIPs. In 1991 the agency issued a draft "General Preamble" that outlines guidance for the states in implementing new requirements. EPA also provided training to state and local officials and issued technical guidance documents on new CAA requirements.

In a notable nonfederal development during 1991, state officials from Northern Virginia to Maine established a regional effort to address the problem of ozone smog that is drifting across

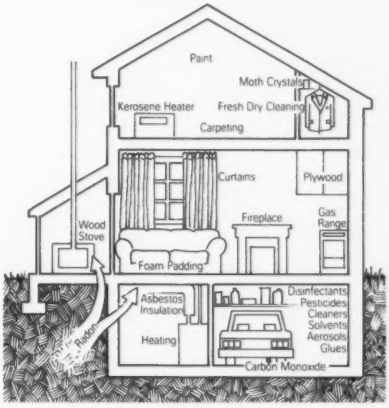
state boundaries. The 1990 act, for the first time, allows officials of these states jointly to propose adopting the stricter automobile emission standards that apply in California.

To reduce pollution and improve visibility in the Grand Canyon National Park, EPA issued a rule reflecting a negotiated agreement among industry, environmental groups, and the National Park Service to reduce emissions of sulfur dioxide by 90 percent at a Navajo powerplant in northern Arizona.

Automobile Emissions (Title II). The new Clean Air Act takes a multifaceted approach to reducing motor vehicle emissions, and in 1991 EPA moved to implement these provisions of the law.

- **Cleaner vehicles.** In May 1991 EPA promulgated stricter tailpipe standards for all vehicular pollutants (hydrocarbons, carbon monoxide, nitrogen oxides, and diesel particulates) to begin with model year 1994. EPA is currently developing other vehicle-related regulations, including tighter require ments for hydrocarbon emissions that result from gasoline evaporation and more stringent heavy-duty bus and truck standards.
- **Cleaner fuels.** In late 1991 EPA proposed standards for reformulated cleaner burning gasoline. Included are oxygenated fuels that must be sold in the worst smog areas of the United States by 1995 to reduce smog and toxic emissions. Areas failing to meet carbon monoxide standards must implement oxygenated fuels programs by November 1, 1992. In addition, Title II requires a clean fuel experimental program in California and the use of clean fuels in large motor vehicle fleets in 21 of the nation's most polluted areas. EPA also proposed new national gasoline volatility control regulations and diesel fuel quality regulations. The reformulated gas rulemaking process was the most ambitious use yet of the Clean Air Act negotiated rulemaking, known as "reg neg." This technique brings affected parties together to work out consensus before EPA proposes rules.
- **Motor vehicle inspection/maintenance programs.** To reduce emissions from existing vehicles, EPA is implementing a CAA provision that requires the nation's worst smog and carbon monoxide areas to improve motor vehicle inspection/maintenance (I/M) programs. Moderate ozone areas are to implement I/M if not previously required.

Air pollution sources in the home.



Source: U.S. Environmental Protection Agency, 1991.

Toxic Air Pollutants (Title III). New regulatory tools address routine and accidental releases of toxic air pollutants—those known or suspected of causing or contributing to serious health

Smoggy cities, 1991.

Ozone

Extreme	Severe	Serious	Moderate	
.280ppm+	*.280-.180ppm*	*.180-.160ppm*	*.160-.138ppm*	
Los Angeles-South Air Basin, CA	Chicago-Gary-Lake County, IL-IN. Houston-Galveston-Brazoria, TX. Milwaukee-Racine, WI. New York-New Jer-Long Is, NY-NJ-CT. Southeast Desert Modified AQMA, CA. Baltimore, MD. Philadelphia-Wilm-Trent, PA-NJ-DE-MD. Ventura Co, CA.	Atlanta, GA. Baton Rouge, LA. Beaumont-Port Arthur, TX. Boston-Lawrence-Worcester (E.MA), MA-NH. El Paso, TX. Greater Connecticut. Muskegon, MI. Portsmouth--Dover Rochester, NH. Providence and all of RI. Sacramento, Metro, CA. San Joaquin Valley, CA. Sheboygan, WI. Springfield and Western MA. Washington, DC-MD-VA.	Atlantic City, NJ. Charleston, WV. Charlotte-, Gastonia, NC. Cincinnati-Hamilton, OH-KY. Cleveland-Akron-Lorain, OH. Dallas-Fort Worth, TX. Dayton-Springfield, OH. Detroit-Ann Arbor, MI. Grand Rapids, MI. Greensboro-Winston Salem-High Point, NC. Huntington-Ashland, WV-KY. Kewaunee Co, WI. Knox Co., Lincoln Co., ME. Lewiston-Auburn, ME. Louisville, KY-	N. Manitowoc Co, WI. Miami-Fort Lauderdale-W.Palm Beach, FL. Monterey Bay, CA. Nashville, TN. Parkersburg, WV. Phoenix, AZ. Pittsburgh-Beaver Valley, PA. Portland, ME. Raleigh-Durham, NC. Reading, PA. Richmond-Petersburg, VA. Salt Lake City, UT. San Francisco Bay Area, CA. Santa Barbara-Santa Maria-Lompoc, CA. St.Louis, MO-IL. Toledo, OH.

Ozone

Marginal *.138-.121ppm*			
Albany-Schenectady-Troy, NY. Allentown-Bethlehem-Easton, PA. Altoona, PA. Birmingham, AL. Buffalo-Niagara, NY. Canton, OH. Cherokee Co., SC. Columbus, OH. Door Co., WI. Edmunson Co., KY. Erie, PA. Essex Co. (Whiteface Mtn),	NY. Evansville, IN. Greenbriar Co., WV. Hancock Co. Waldo Co., ME. Harrisburg-Lebanon-Carlisle, PA. Indianapolis, IN. Jefferson Co., NY. Jersey Co., IL. Johnstown, PA. Kent Co.-Queen Anne's Co., MD. Knoxville, TN. Lake Charles, LA. Lancaster,	PA. Lexington Fayette, KY. Manchester, NH. Memphis, TN. Norfolk-Vir. Beach-Newport News, VA. Owensboro, KY. Paducah, KY. Portland-Vancouver AQMA, OR-WA. Poughkeepsie, NY. Reno, NV. Scranton-Wilkes-Barre, PA. Seattle,	Tacoma, WA. Smyth Co. (White Top Mtn) WV. South Bend-Elkhart, IN. Sussex Co, DE. Tampa-St.Petersburg-Clearwater, FL. Walworth Co, WI. York, PA. Youngstown-Warren-Sharon, OH-PA. (SubMarginal Kansas City, MO-KS)

Smoggy cities, (continued)

Carbon monoxide

Serious	Moderate-1	Moderate-2
16.5ppm+	*16.4-12.7ppm*	*12.7-9.5ppm*
Los Angeles-South Coast Air Basin, CA.	Anchorage, AK. Denver-Boulder, CO. Fresno, CA. Las Vegas, NV. New York-No. New Jer-Long Is, NY-NJ-CT. Provo, UT. Seattle-Tacoma, WA. Spokane, WA.	Albuquerque, NM. Baltimore, MD. Boston, MA. Chico, CA. Cleveland, OH. Colorado Springs, CO. Duluth, MN. El Paso, TX. Fairbanks, AK. Fort Collins, CO. Grant Pass, OR. Hartford-New Britain-Middletown, CT. Klamath Falls, OR. Lake Tahoe South Shore, CA. Longmont, CO. Medford, OR. Memphis, TN. Minneapolis-St.Paul, MN. Missoula, MT. Modesto, CA. Ogden, UT. Philadelphia-Camden Co, PA-NJ. Phoenix, AZ. Portland-Vancouver, OR-WA. Raleigh-Durham, NC. Reno, NV. Sacramento, CA. San Francisco-Oakland-San Jose, CA. San Diego, CA, Stockton, CA. Syracuse, NY. Washington, DC-MD-VA. Winston-Salem, NC.

Note: Categories for U.S. urban areas failing to attain national health standards are based on human health impacts. Clean Air Act requirements vary according to the severity of an area's air quality problems. ppm = parts per million.

Source: U.S. Environmental Protection Agency, 1991.

problems, such as cancer or reproductive disorders. According to U.S. industry estimates, more than 2.4 billion pounds of toxic pollutants were released into the atmosphere in 1989. Title III lists 189 toxic air pollutants as the basis for emissions controls in the near term. Over a 10-year period, EPA will issue regulations covering all major sources of toxic air pollution. EPA has developed a draft list of categories of sources that emit these 189 pollutants and, in November 1991, proposed regulations to control emissions of toxics from dry cleaners. Programs to ensure the control of high emitting sources such as chemical plants are under development.

To encourage early emission reductions through pollution prevention programs, Title III allows companies that voluntarily and permanently reduce toxic air pollutants in advance of the legislated deadline the option of postponing installation of maximum available control technology.

Acid Rain Program (Title IV). In 1991 EPA proposed regulations to implement the Title IV acid rain control program, which has the following components:

- **Emissions allowances.** An innovative market-based system of sulfur dioxide emissions allowances will bring about a 10 million-ton reduction in sulfur dioxide emissions at the least cost by the turn of the century;
- **Permitting system.** A flexible permitting system complements

NAPAP: State-of-the-Art Environmental Analysis

Title IX of the 1990 Clean Air Act Amendments reauthorized the National Acid Precipitation Assessment Program, which was first established by Congress in 1980 as a 10-year interagency research initiative. The renewed program will continue to monitor emissions, deposition, and effects of acidic air pollutants and will develop basic research and models. Also, for the first time ever in a major environmental statute, the acid rain title of the Clean Air Act required that cost and benefit analyses be conducted by NAPAP as the new law is implemented.

The following federal agencies serve on a NAPAP Interagency Council chaired by the Council on Environmental Quality: EPA, National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration (NASA), and the departments of Energy, Agriculture, and the Interior. In December 1991 NAPAP released three documents to the public:

- *Mission, Goals, and Program Plan, Post 1990.* This draft document, released for public comment, lists goals for coordinating federal research and evaluating the effectiveness of the nation's acid rain control program.
- *Acidic Deposition: State of Science and Technology Summary Report.* A series of 27 reports summarizes the results of scientific and engineering studies conducted by NAPAP in the 1980s at a cost of nearly $600 million.
- *NAPAP Integrated Assessment.* Using scientific, technological, and economic data from the first decade of NAPAP research, this document describes current and projected acid rain conditions and potential costs and benefits of different emission reduction scenarios.

market-based components by allowing sources to tailor compliance plans to meet specific needs and react quickly to changing market conditions;

- **Emissions monitoring.** A continuous emissions monitoring requirement ensures that CAA emissions reduction goals are met; and
- **Emissions cap.** An overall permanent cap on utility emissions of sulfur dioxide ensures that environmental benefits are not eroded over time.

Permit Program (Title V). Title V requires all major sources of air pollution to have federal permits as a condition of operation. These permits, administered at the state level, form the basis for enforcement of the new Clean Air Act. In April 1991 EPA proposed regulations listing the requirements of state permit programs.

Ozone Layer Protection (Title VI). Title VI establishes a comprehensive program to phase out most ozone-depleting substances such as chlorofluorocarbons (CFCs) by the year 2000. Moving beyond CAA requirements and international agreements, President Bush in February 1992 unilaterally accelerated the U.S. phaseout deadline by four years, to the end of 1995. A federal tax on ozone-depleting substances established in 1989 already has provided a strong incentive to shift away from these chemicals. U.S. production of these substances is already more than 40 percent below what is permitted by CAA and international agreements.

Other Provisions (Titles VII-XI). Title VII of CAA increases the range of civil and criminal sanctions available in enforcement of the Act. Titles VIII and IX authorize extensive research programs to measure, monitor, and analyze air pollutants and investigate alternative energy sources, and Title IX extends and expands the National Acid Precipitation Assessment Program. Title X addresses disadvantaged business concerns, and Title XI establishes a program to provide income payments, training, and employment services to workers who are terminated or laid off as a result of CAA implementation.

International Agreements

Because air quality is also a global, transboundary concern, the United States supports concerted efforts to reduce air pollution on an international basis. For example, in March 1991, the United States negotiated an Air Quality Agreement with Canada that provides a framework for dealing with air quality matters. Both countries have made commitments to national emissions caps and additional programs designed to reduce transboundary emissions of sulfur dioxide and nitrogen oxides.

The United States is a leader among the 70 nations that are parties to the 1987 Montreal Protocol and its 1990 London Amendments—landmark agreements that limit and eventually phase out the use of ozone-depleting substances.

The United States also is taking part in negotiations for a framework convention on climate change to include commitments by all nations to develop action plans.

For further discussion of these issues, see the International Issues section of this report.

Indoor Air and Radon

Although the CAA amendments do not address indoor air pollution, federal agencies including EPA, the Department of Energy, and the National Institute of Environmental Health Sciences in the Department of Health and Human Services conduct the following programs:

- Risk management and epidemiological studies using existing data on exposures and health risks associated with indoor air pollutants;
- Data collection on sources, exposure, and health risks where information gaps exist;
- Studies of the relationship between energy efficiency measures (such as improved insulation) and indoor air quality;
- Strategies to abate present levels of exposure to indoor pollutants;
- Regulatory programs within EPA and other federal agencies to prohibit or otherwise restrict products that could exacerbate levels of exposure; and

- Educational programs to inform the public of indoor air pollution and its associated health risks and prevention options.

The U.S. government encourages homeowners and schools to test for elevated radon levels and to mitigate problems where they exist. The government takes this message to the public through national public service announcements and cooperative efforts with state and local governments and with private organizations such as the American Lung Association and the American Medical Association.

Biodiversity

Maintain, wherever possible, an environment which supports diversity...
National Environmental Policy Act, section 101(b)(4)

Also see Fisheries and Marine Mammals, Public Lands, Wetlands, and related tables and figures in Part II.

The biological wealth that scientists call biodiversity encompasses the Earth's rich variety of distinct species, the genetic variability within them, and the ecosystems they inhabit. Ecosystems—the functional units formed by plant and animal communities as they interact with their physical environment—are crucial to human health and prosperity. Existing technologies cannot assess the exact status of biodiversity, but current evidence offers reason for concern.

Conditions and Trends

Although species impoverishment and habitat degradation appear most severe in developing nations that are converting tropical rainforests to cropland and pasture, biodiversity is also a concern in the developed world. Across the many ecoregions of the United States, data suggest sharp declines in some plant and animal communities, in the species that inhabit them, and in the genetic diversity within species. Population declines or fragmentations that diminish genetic diversity within a species also diminish the flexibility of a species over time and raise the risk of species extinctions.

Policies and Programs

In 1991 federal agencies, Congress, the states, and private organizations took steps to promote U.S. and global biodiversity and to stem its loss. A sampling of policies and programs follows.

Bioregions

The State of California has introduced the concept of bioregions—large, contiguous, geographic areas in which biological and physical components have similar structure and function—to the management of its public lands and waters. After identifying 11 bioregions, the state entered into agreements with major federal and state land manage-

Playa Lakes Joint Venture, Phillips Petroleum.

To reverse duck population declines, industries are joining with environmental groups to sponsor habitat conservation projects.

U.S. Biodiversity Trends

Data on U.S. flora and fauna, such as the following, indicate a pattern of losses in biodiversity nationwide:

• **Endangered species.** In 1991 the U.S. Fish and Wildlife Service (FWS) added 71 domestic species to the Threatened and Endangered Species List, bringing U.S. species on the list to 668. Some 4,000 species remain candidates for listing. The total list including foreign species had 1,196 species. A 1990 assessment of recovery status for listed species revealed 38 percent declining, 10 percent improving, 31 percent stable, 2 percent extinct, and 19 percent of unknown status. Among notable listing events in 1991, the California gray whale was removed from the endangered species list; the Snake River sockeye salmon was listed as endangered; and the Sacramento River winter-run chinook salmon was listed as threatened.

• **Ducks and geese.** The annual FWS Fall Flight Forecast showed populations for six of the ten duck species counted down from 1990 levels; nine of the ten were down over the 1955-1991 period. Less complete information for geese populations showed a majority of subspecies and populations increasing over the 1990-1991 period. Ducks may be

Biodiversity Trends, (continued).

more affected by breeding habitat losses—primarily wetlands conversion—in the lower latitudes of North America, while geese, which breed further north, may be less affected. Also some Canadian geese are becoming urbanized and no longer migrate.

• **Raptors.** Fall 1990 surveys of East Coast raptors by the Cape May (NJ) Bird Observatory showed population counts down for sharp-shinned hawks and American kestrel, the most common varieties. Osprey, Cooper's hawk, merlin, and peregrin falcon—species thought to have been affected by the now banned DDT—apparently are recovering.

• **Migratory birds.** Long-term studies by researchers at the Hubbard Brook Experimental Forest (NH) of birds that winter in neotropical regions and migrate to North America during the summer suggest that changes in U.S. habitat, especially fragmentation, may be as responsible for declines in bird populations as loss of habitat in the neotropics.

• **Marine ecosystems.** The loss of fish species at or near the top of a food web can destabilize an entire marine ecosystem. Fish stocks within the Exclusive Economic Zone off U.S. coasts are showing significant declines, as are Great Lakes, coastal zone, and anadromous stocks. Affected species include Pacific and Atlantic salmonids, striped bass, lake trout, and Atlantic sturgeon.

• **Freshwater ecosystems.** Many of the 700 freshwater fishes, 300 mussel species, and 300 crayfish species that inhabit the nation's rivers and lakes are endangered. One in ten North American freshwater mussel species has become extinct in this century, primarily because of habitat loss and introduced exotic species. Pollution, genetic impoverishment, and overharvesting are also factors.

• **Wetlands.** Surveys conducted by FWS and the Department of Agriculture find rates of wetlands losses declining over the most recent periods studied. Wetlands restoration technologies may help to further reduce habitat loss in these species-rich ecosystems.

• **Tall-grass prairies and old-growth forests.** Two diverse ecosystems that once dominated the U.S. landscape exist today in fragments that represent small percentages of their historic levels. The decline of these habitats imperils species dependent on them for survival, such as the northern spotted owl that inhabits old-growth forests of the Pacific Northwest.

California bioregions, with natural areas and watersheds.

Source: State of California, Interagency Natural Areas Coordinating Committee, 1991.

ment agencies to cooperate on such concerns as the protection of endangered species and water quality. Signatories included the California departments of Fish and Game, Forestry, Fire Protection, Parks and Recreation, and Lands Commission, the University of California Division of Agriculture and Natural Resources, and the U.S. Fish and Wildlife Service, the Bureau of Land Management (BLM), and the USDA Forest Service. Other states including Michigan are considering this approach.

Ecosystem Education

Through a program called "Watchable Wildlife," federal agencies and private organizations are cooperating to offer opportunities for the public to observe native North American wildlife in natural settings. In 1991 parties to a memorandum of agreement on the program worked together to publicize wildlife viewing and to provide facilities, interpretation, and access. A copyrighted symbol of a binoculars will help identify Watchable Wildlife areas.

Ecosystem Restoration

The USDA Forest Service, BLM, and the National Fish and Wildlife Foundation (a Congressionally chartered nonprofit organization) are cooperating on a program called "Bring Back the Natives." To restore native plant and animal species, the program emphasizes ecosystem management through such efforts as coordinated streamwide restoration to recover entire aquatic systems.

Gap Analysis

Cooperative research units of the Fish and Wildlife Service have developed computer-based gap analysis to measure elements of biodiversity. The technique uses satellite imagery and geographic information systems to identify and map vegetation and vertebrate distribution. Scientists can then compare these elements to current land-use practices and ownership patterns and target areas in need of additional protection or improved management to conserve biodiversity. In 1991 FWS conducted gap-analysis projects in 14 states, cooperating with the Bureau of Land Management, the National Park Service, the Forest Service, and with private groups such as the Nature Conservancy. Working together, these groups are expanding gap analysis into a nationwide assessment.

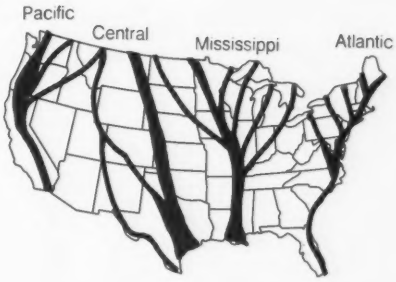
Global Change and Biodiversity

In 1991 FWS initiated a project under the U.S. Global Change Research Program to monitor and assess the impacts of global change on biodiversity. Field and laboratory research will use standardized assessments of population and distribution of several fish and wildlife species to relate climate change to ecological and physiological responses.

Duck breeding populations in North America.

Source: Based on population estimates for ten duck species presented in Part II, Table 76.

Flyways of North American ducks.

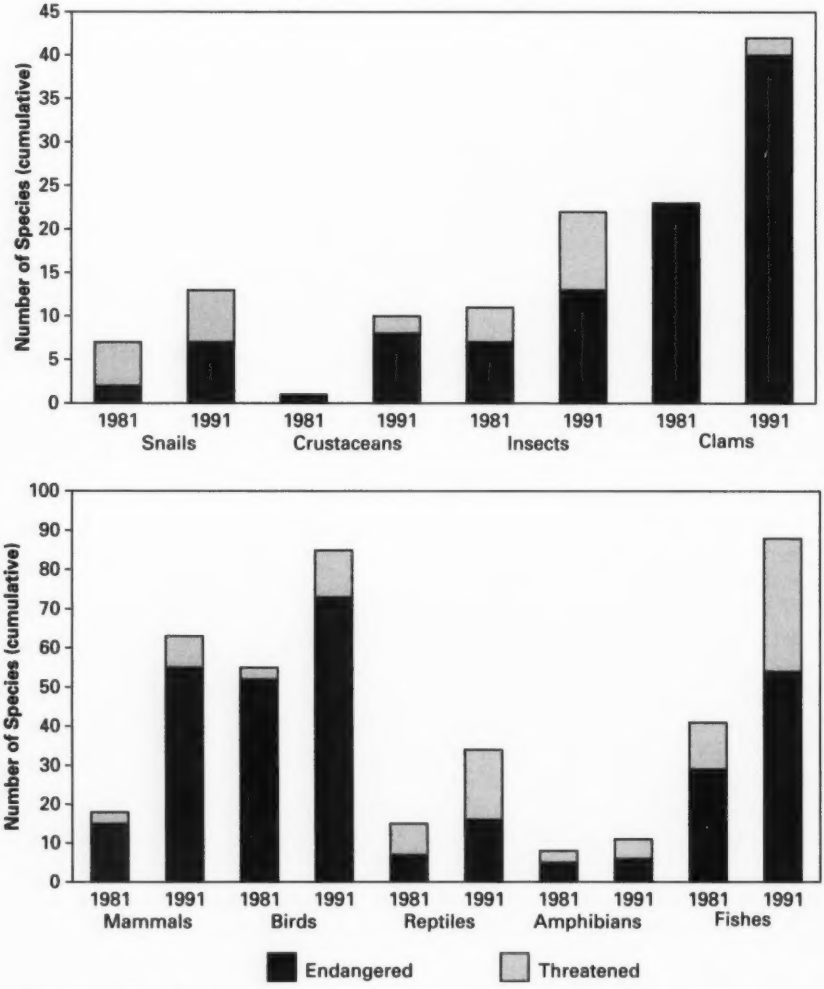


Source: Council on Environmental Quality, *Environmental Trends,* (Washington, DC: CEQ, 1989), page 106.

International Conventions

The United States is taking part in international negotiations on agreements to protect biological diversity and global forests. Efforts are aimed at producing agreements or statements of principle for signature in conjunction with the U.N. Conference on Environment and Development (UNCED) to be held in Brazil in June 1992. In a related project, U.S. federal agencies are participating in the North American Consultation on a draft Biological Diversity

Threatened and endangered species in the United States.



Source: See Part II, Table 80.

Strategy and Action Plan. The strategy is a joint effort of the United Nations Environment Programme (UNEP), the International Union for the Conservation of Nature and Natural Resources (IUCN), and the World Resources Institute (WRI).

Keystone Report

In April 1991 the final report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands presented the views of many land management professionals. The policy dialogue, which took place over the course of two

years, was coordinated by the nonprofit Keystone Center of Colorado. Participants included the USDA Forest Service, FWS, BLM, National Park Service (NPS), Environmental Protection Agency (EPA), Department of Defense (DOD), and a number of academic, industry, and conservation leaders. Although the Keystone Report does not represent federal policy, it is the most visible effort to date toward forging a federal position on biodiversity. The report describes a range of activities, all of which can be undertaken as part of existing programs, to protect and maintain biodiversity on federal lands. Several agencies, including the Forest Service, have incorporated elements of the Keystone recommendations into their policies and procedures.

Legacy Resource Management

The fiscal 1991 Department of Defense appropriations bill called for a Legacy Resource Management Program to achieve the following objectives:

- Identify, inventory, and manage significant biological, geophysical, cultural, and historic resources involving DOD lands;
- Protect significant systems and species;
- Establish a standard DOD methodology for collecting, storing, and retrieving biological resource information, compatible with that used by state Natural Heritage Programs; and
- Establish restoration and rehabilitation programs for altered or degraded habitats.

As part of the program, DOD has taken 100 separate actions on 80 military installations, involving ten major commands and 48 public and private partners in 39 states, territories, and the District of Columbia. In November 1991 Congress approved fiscal 1992 appropriations of $25 million for the program.

Legislation

In 1991 Congressional committees considered legislation regarding conservation of biodiversity that included the following provisions:

- Establish a national center for biodiversity research,
- Mandate the formation of an interagency committee on the subject,
- Authorize research grants to states and private organizations, and
- Expand land management consultation between the Fish and Wildlife Service and other federal agencies.

CEQ and other federal agencies testified in opposition to the bills, indicating that while the Administration is committed to expanding conservation of biodiversity, the proposed legislation would be needlessly costly and redundant compared to an approach using existing federal authorities.

Managed Landscapes

In 1991 USDA, the U.S. Agency for International Development (AID), and EPA worked with academic institutions and conservation organizations to plan a July 1992 international symposium on "Biodiversity and Managed Landscapes."

Marine Biodiversity

Recognizing the urgent need to address marine biodiversity, the Center for Marine Conservation, a nonprofit organization, hosted the first major scientific conference on the subject in late 1990. Meeting at the Smithsonian Institution, conference participants concluded that threats to marine biodiversity are greater than previously acknowledged. The current focus—protecting species-

rich areas and reducing extinctions—is insufficient to address concerns. Many species-rich areas are linked to less obviously diverse areas in such a way that protection of both may be required to protect either one. Even though population changes may not result in extinction, they can destabilize marine ecosystems with attendant effects on other species, including valuable commercial ones.

NEPA Conference Series

The Council on Environmental Quality, with support from the Department of Defense, EPA, and the Fish and Wildlife Service, in 1991 initiated a series of regional conferences on incorporating ecological concerns into the environmental assessment process under the National Environmental Policy Act. Designed for federal staff involved in managing, preparing, or reviewing NEPA documents, the conferences feature biodiversity prominently among the topics covered.

Neotropical Migratory Birds

In 1991 federal agencies and private organizations created a Federal Neotropical Migratory Bird Conservation Committee to identify conservation needs for these species and to coordinate implementation of programs for them. In addition, the National Fish and Wildlife Foundation sponsored an initiative to coordinate efforts to deal with problems affecting neotropical migrants.

Species Recovery

Through a program called "Every Species Counts," the Forest Service is attempting to recover and conserve plants and animals on the U.S. Threatened and Endangered Species List. By 1991 the Forest Service had identified over 200 threatened or endangered species in national forests. Included within the National Forest System are rare and protected plant and animal communities on 34 million acres of wilderness and Special Interest Areas and on 200,000 acres of Research Natural Areas. Groups such as the Nature Conservancy and the State Heritage Programs in all 50 states assist the Forest Service with inventory and data management of rare species and biological communities.

Budget

Use all practical means and measures, including financial and technical assistance...to create and maintain conditions under which man and nature can exist in productive harmony...
National Environmental Policy Act, section 101(a)

The proposed fiscal 1993 federal budget continues efforts of the Bush Administration to increase investments in parks, forests, outdoor recreation, pollution control, hazardous waste cleanup, and energy research and development. The budget proposal includes an overall increase of $3.2 billion or 21 percent over 1992 funding for environment and natural resources initiatives.

Policies and Programs

A summary of environmental highlights from the 1993 budget follows.

Air Quality

The 1993 budget provides funding of $229 million to implement the Clean Air Act Amendments of 1990 (CAA). This represents a $42 million increase over 1992 funding, on top of a $187 million increase in CAA activities over the last two years.

Coasts and Oceans

The 1993 budget supports the conservation of coastal and ocean resources through such programs as the following:

- **Coastal Ocean Program.** A total of $17 million, a 48-percent increase, would support the Coastal Ocean Program of the National Oceanic and Atmospheric Administration (NOAA) and its ocean research projects.
- **National Marine Sanctuaries.** The budget provides over $7 million, a 46-percent increase, for the designation and management of national marine sanctuaries.
- **Fisheries and Marine Mammals.** To conserve living marine resources, funding of $219 million would strengthen the federal role in fisheries management through pro grams sponsored by the NOAA National Marine Fisheries Service.
- **Coastal America.** The budget proposes the continuation of the Coastal America program at existing funding

Highlights of the President's Fiscal 1993 Budget

- Protect and expand national parks, forests, wildlife refuges, and other public lands;
- Nearly triple federal contributions to partnerships with state governments to enhance state parks and other outdoor recreation facilities;
- Target special funds to protect natural resources in the nation's "crown jewel" national parks;
- Support the Environmental Protection Agency (EPA) with an operating budget of nearly $2.7 billion and more than 14,000 employees;
- Increase funding to clean up federal facilities—nuclear and non-nuclear—to ensure that the federal government meets the legal requirements of various signed agreements, court decrees, statutes, and regulations;
- Increase pollution control and resource protection for a range of programs along the U.S.-Mexican border in support of a North American Free Trade Agreement;
- Accelerate construction of sewage treatment plants in major coastal cities;
- Continue full and timely implementation of the Clean Air Act Amendments;
- Accelerate the cleanup of Superfund hazardous waste sites;
- Target efforts to reduce contamination in specific geographic areas;
- Fully implement the President's strategy to protect and enhance the nation's wetlands without unduly interfering with needed economic growth or private property rights;
- Expand research into the causes of global change, thereby extending U.S. leadership in this critical area;
- Improve the efficient use of energy in the federal government and assure development of even more efficient technologies in the future by increasing the budget for conservation research and development.

levels. Through this interagency initiative, the Council on Environmental Quality, the Environmental Protection Agency (EPA), the Department of Commerce, the Army Corps of Engineers, and the Department of the Interior (DOI) focus on preserving and restoring eroding coastal wetlands.

Energy

To balance energy conservation and production, the 1993 budget proposes almost $1 billion a year in energy research and development (R&D). Of this total, $350 million would support energy conservation R&D to increase efficiency in residential and commercial buildings, in industry, and in the transportation sector. Funding of $162 million for cleaner, more efficient transportation technologies would support such projects as a government-private sector joint research venture to develop batteries for electric vehicles. Purchase of 5,000 alternative-fuel vehicles (AFVs) would put the federal government two years ahead of the AFV purchase schedule required by the Clean Air Act. R&D investments of $47 million for environmentally sensitive domestic oil development plus regulatory reform could help boost domestic oil supplies by 3.8 million barrels per day by the year 2010. The budget proposes $40 million for natural gas R&D to address production issues and cleaner and more efficient use of the fuel.

The budget proposes $500 million to fund Rounds 4 and 5 of the Clean Coal Technology Program, a government-industry cost-shared demonstration program to improve methods of using coal more cleanly, efficiently, and economically. Funding of $250 million would support R&D of renewable energy resources to generate electricity, including hydroelectric, solar, wind, biomass, geothermal, and technologies to convert municipal solid waste to energy. Funding of $392 million would support nuclear waste management programs, including $248 million for studies of the suitability of the Yucca Mountain site as a permanent nuclear-waste repository.

Federal Facility Cleanups

To ensure that federal facilities live up to the same environmental standards as private facilities, the Bush Administration has tripled funding for waste cleanup at federal sites and for compliance with applicable environmental laws and regulations. Within the federal government, the Department of Energy (DOE) and the Department of Defense (DOD) led in numbers of sites and in proposed funding for federal facility cleanup.

Department of Energy. The proposed funding in fiscal 1993 of $5.5 billion for DOE cleanups was the result of extensive interagency consultations and field studies. This level of funding would allow DOE to meet all legal and internal management requirements related to environmental cleanup and compliance.

An interagency review panel is considering recommendations to improve long-term management of the DOE environmental restoration and waste management program. The 1993 budget provides $1.9 billion for DOE environmental restoration upon closure of waste treatment, storage, and disposal facilities and for remediation of inactive sites and underground storage tanks. Another $3 billion for waste management at active DOE facilities

U.S. budget for the environment.

Summary of proposed major initiatives for fiscal 1993	1989 Actual	1992 Enacted	1993 Proposed	1992-1993 dollar	Change percent
		million $			%
America the Beautiful	863	1,491	1,653	+162	+11
Reforestation	12	66	139	+73	+111
State LWCF: Partnership with States for Parks and Outdoor Recreation	17	23	60	+37	+158
Federal Facility Cleanup:					
Department of Energy	1,762	4,407	5,534	+1,127	+26
Department of Defense*	1,155	2,761	3,718	+957	+35
Other Agencies	106	203	236	+33	+16
Border Pollution: Pollution Control Along the U.S.-Mexico Border in Support of NAFTA	34	103	201	+98	+95
Providing Clean Waters for America's Cities:					
Boston	25	100	100	—	—
New York	—	70	70	—	—
Baltimore	—	40	40	—	—
Los Angeles	—	55	55	—	—
San Diego	—	40	40	—	—
Seattle	—	35	35	—	—
EPA Operating Budget	1,752	2,578	2,698	+120	+5
Superfund	1,410	1,616	1,750	+134	+8
Protecting America's Wetlands	295	600	812	+212	+35
Army Corps of Engineers: Protection and Restoration of Environmental Resources	196	361	408	+47	+13
Global Change Research	—	1,110	1,372	+262	+24
Total**	7,388	15,132	18,292	+3,160	+21

Note: EPA = U.S. Environmental Protection Agency; LWCF = Land and Water Conservation Fund; and NAFTA= North American Free Trade Agreement.

* Does not include anticipated $1 billion 1992 supplemental.

** Total has been adjusted to eliminate double counting, including DOI wetlands and federal facility cleanup in America the Beautiful and global change research, border pollution, and wetlands activities in the operating budgets of EPA and the Army Corps of Engineers.

Source: Executive Office of the President, Office of Management and Budget, *Budget of the U.S. Government*, (Washington, DC: U.S. Government Printing Office, 1992).

would support minimization, treatment, storage, and disposal of radioactive, hazardous, and mixed and sanitary wastes. Funding of $315 million would support DOE research and development of such technologies as site characterization to determine the spread of contamination, soil and groundwater remediation, waste retrieval and processing, creation of waste forms suitable for disposal, and pollution prevention through process changes, materials substitution, and recycling.

Department of Defense. Proposed 1993 funding of $3.7 billion would support DOD site cleanup and compliance with environmental laws. An expected $1 billion supplemental appropriations request for fiscal 1992 will accelerate cleanup of contaminated DOD sites.

Hazardous and Solid Wastes

For the fourth year in a row, the Administration requested a substantial increase to clean up Superfund sites—public and private. The 1993 budget requests $1.75 billion and continues to shift efforts from support activities to actual cleanup. Proposed funding would allow EPA to reduce the risk of hazardous and solid wastes to human health and the environment.

International Issues

The proposed 1993 budget reflects the increasingly international nature of environmental issues.

Global change research. Proposed funding of $1.37 billion would expand the U.S. Global Change Research Program by 24 percent. Among a number of initiatives, a National Aeronautics and Space Administration program called Mission to Planet Earth provides space-based observations of environmental change to complement ground-based data. Expanding research into the causes of global change extends U.S. leadership in this critical area.

U.S.-Mexican Border. The 1993 budget includes $201 million for environmental projects consistent with the U.S.-Mexican Border Environmental Plan and the proposed North American Free Trade Agreement. Funding would support wastewater treatment in major cross-border population centers, provision of drinking water and wastewater treatment to communities along the U.S. side of the border that lack such services, expedited action on air quality problems in twin border towns, and more aggressive joint enforcement of hazardous waste and other environmental laws.

Public Lands—America the Beautiful

The 1993 budget builds upon the President's America the Beautiful (ATB) initiative, being implemented jointly by the departments of the Interior and Agriculture. Under the ATB umbrella, funding of nearly $2 billion would improve stewardship of national parks, forests, wildlife refuges, and other public lands. To help achieve the President's goal of planting 1 billion trees per year, funding of $139 million supports reforestation on private nonindustrial forestlands. Another proposal is an America the Beautiful passport that would cost $30 and provide 12 months of access to federal outdoor recreation areas. Revenues would go to improve federal lands and waters and expand recreational opportunities.

To protect the nation's most popular and ecologically sensitive national parks, the President again is proposing $10 million for a Targeted Parks initiative. The budget also contains $10 million for a fivefold expansion of a 1992 initiative, the American Battlefield Pro-

tection Program. Proposed funding of $306 million would support acquisition of priority lands by the National Park Service, the Fish and Wildlife Service, the Bureau of Land Management, and the Forest Service, with lands rated by proximity to population centers, recreational opportunities, ecologically valuable wetlands, and endangered species. Proposed 1993 funding of $60 million would support the Land and Water Conservation Fund (LWCF) program of state park and outdoor recreation grants. Expanded LWCF state grants can be cost-effective alternatives to federal acquisition and operation of outdoor recreation areas.

The budget also requests $41 million for the Historic Preservation Fund Program of the National Park Service, which provides state grants; $1 million for the National Trust for Historic Preservation; and $4 million for a joint DOI/United Negro College Fund effort to preserve the campuses of historically black colleges and universities (HBCU) across the nation.

Water

Proposed funding would support water resource agencies, such as the Army Corps of Engineers and the Bureau of Reclamation, with environmental protection, mitigation, and restoration at specific water projects. For example, the budget provides for work by the Army Corps on the Columbia and Snake rivers to help restore salmon populations. Bureau of Reclamation funding of $84 million covers restoration of fish and wildlife resources along the Trinity and Sacramento rivers.

The 1993 budget provides $2.5 billion for wastewater treatment grants, a $100 million increase over the 1992 level. More than $2 billion would help capitalize state revolving funds, allowing states to assume full responsibility for wastewater treatment.

Funding of $340 million would support cost-shared coastal city grants for secondary or advanced treatment of municipal sewage in six U.S. cities with the largest unmet treatment needs—New York, Boston, Baltimore, Los Angeles, San Diego, and Seattle.

The budget would expand and intensify multimedia initiatives in such high-profile water quality programs as the Great Lakes, Chesapeake Bay, and Gulf of Mexico.

Wetlands

The 1993 budget continues to support the President's strategy to protect, enhance, and restore the nation's wetlands with a 35-percent overall increase in funding for such efforts as these:

- **Wetlands Reserve Program.** During the 1993-1995 period, funding of nearly $800 million would encourage farmers to remove priority wetlands from production through voluntary long-term conservation easements.
- **North American Wetlands Conservation Act.** Funding of $15 million would accelerate implementation of the North American Waterfowl Plan to restore declining migratory bird populations.
- **Wetlands protection and restoration.** Funding of $50 million would support programs managed by DOI and the Army Corps of Engineers to conserve and restore coastal wetlands.
- **Everglades National Park.** Funding of $15 million would help restore waterflows at the Everglades National Park in Florida.

Coasts and Oceans

Conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality...
National Environmental Policy Act, section 204(5)

Also see Fisheries and Marine Mammals, Wetlands, and related tables and figures in Part II.

Millions of U.S. families are moving to the coasts, attracted by the scenery and recreation they offer. One result is that coastal resources are under increasing pressure from population growth and development. Almost half the U.S. population—110 million people—now live in coastal counties, which comprise only 11 percent of the nation's land area (excluding Alaska). By the year 2010, the coastal population may well exceed 127 million people.

Conditions and Trends

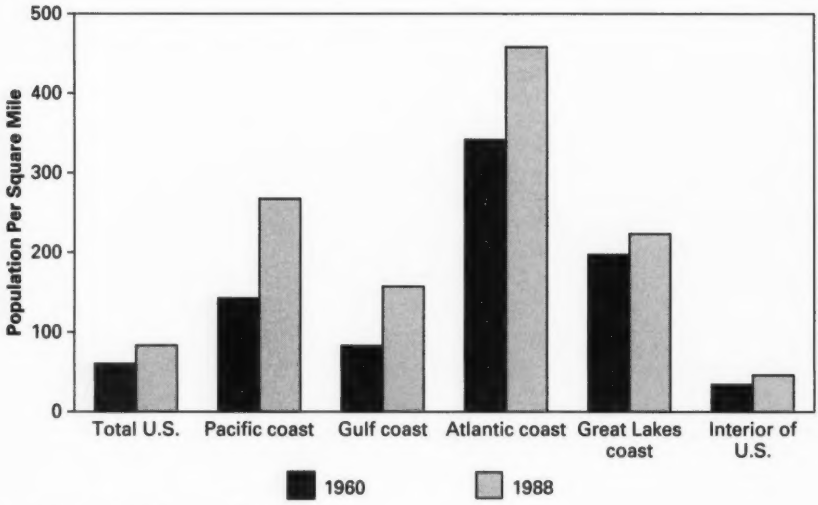
While water quality has improved in many lakes and rivers in the last generation, the cumulative impact of human actions in the coastal environment has resulted in water quality degradation, habitat impoverishment, and declines in living marine resources when compared to conditions at the beginning of this century.

Pollution Sources and Loadings

Unregulated nonpoint sources of pollution, such as runoff from agricultural lands, urban areas, and other types of land uses, account for half of all pollution loadings to coastal waters. Of the nation's 66,000 point sources of wastes, mostly municipal and industrial sources regulated under the Clean Water Act, 10 percent are located in coastal areas. Yet this 10 percent accounts for over one-third of the total volume of wastewater. Of all abandoned hazardous waste sites in the nation, 28 percent are located in coastal areas. These coastal sites make up 35 percent of the Environmental Protection Agency (EPA) Superfund National Priorities List.

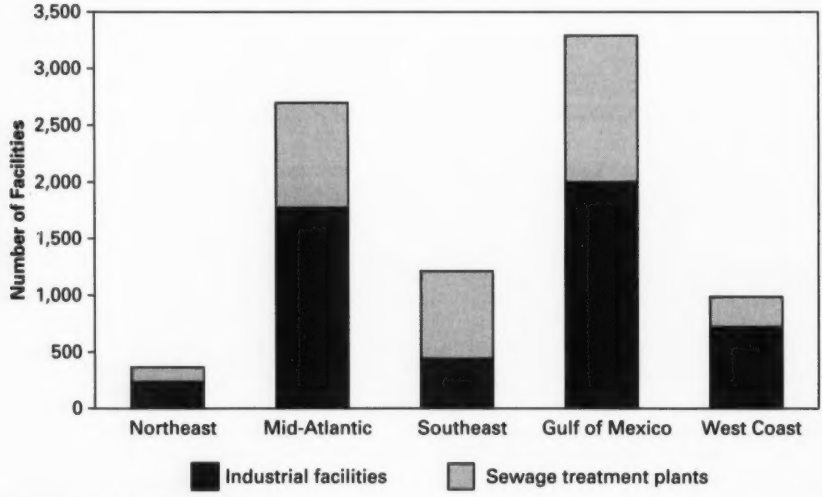
In recent years, coastal areas have experienced problems with combined sewer overflows (CSOs) that occur where sanitary and storm sewers are interconnected. During rainstorms, such systems become overloaded, bypass treatment works, and discharge as much as 90 percent of the pollutants

Changes in U.S. population density.



Source: See Part II, Table 6.

Point source dischargers to U.S. coastal waters.



Note: Data is for mid-1980s.
Source: U.S. Department of Commerce NOAA, *Estuaries of the United States*, (Washington, DC: NOAA, 1990.)

Major coastal pollution problems.

▲ High levels of toxic chemicals in fish livers

■ PCB or pesticide contamination

○ Areas of oxygen depletion

● Areas in which more than one-third of acreage is closed due to commercial shellfish harvest

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1991.

they contain. The untreated wastes often contain high levels of suspended solids, floatables, heavy metals, nutrients, bacteria, and other wastes. CSO discharges have led to beach closings along both Puget Sound and the New York/New Jersey/Connecticut shorelines; they are primarily responsible for the permanent closure of 25 percent of the shellfish beds in Narragansett Bay.

Toxic Contaminants

High levels of toxic contaminants can be found in the sediments and organisms of coastal waters surrounding the heavily urbanized areas of the Northeast and West Coast. Although some contaminants appear to be increasing, lead and polychlorinated biphenyls (PCB) are decreasing because of the switch to lead-free gasoline and a ban on PCBs.

Habitat Impoverishment

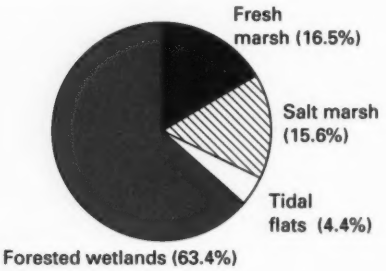
Over the last century, human actions have altered and degraded many coastal wetlands, which account for one-third of all the nation's wetlands and support 70 percent of U.S. commercial fisheries. Between the mid-1950s and the mid-1970s, these habitats were lost at a rate of approximately 18,000 acres per year. California has lost 91 percent of its submerged aquatic seagrass beds.

Living Resources Declines

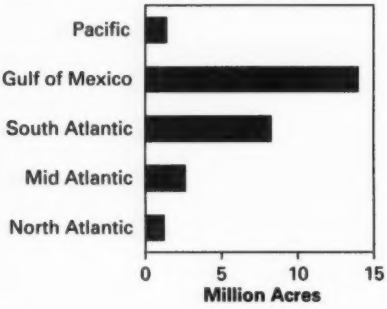
Overfishing, habitat impoverishment, and water quality degradation have reduced most estuarine-dependent finfish and shellfish species to historic low levels. The number of fish kill events in coastal areas has increased, with low-dissolved oxygen the direct cause in over 40 percent of the cases.

Coastal wetlands by habitat, region, and leading states.

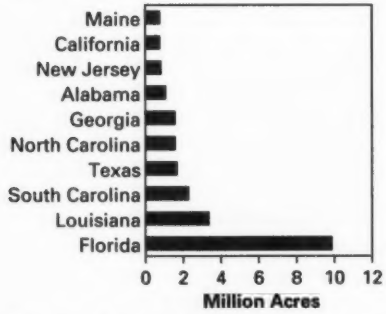
Habitat



Region



Leading States



Note: Data is for the mid-1980s.
Source: See Part II, Table 65.

Shellfish beds approved as safe for consumption have also decreased; in fact, 17 of 22 coastal states have lost shellfish acreage to pollution since 1986.

Policies and Programs

Four federal agencies have responsibility for the U.S. coastal environment:

- National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce,
- Environmental Protection Agency,
- Department of the Interior (DOI), and
- U.S. Army Corps of Engineers (COE).

NOAA and the DOI/Fish and Wildlife Service have primary stewardship responsibilities for living marine resources, while EPA regulates water quality and COE regulates dredging, filling, and erosion control operations. A sampling of coastal programs sponsored by these agencies follows.

Bay/Estuary Programs

The 1987 Clean Water Act Amendments called for EPA coastal programs with a geographic focus. In addition, several other agencies also have geographically focused efforts.

EPA partnership programs include the National Estuary Program, which identifies management actions to improve water quality in 17 threatened or impaired estuary ecosystems; the Near Coastal Water Initiative; the Chesapeake Bay Program; the Great Lakes Program; and the Gulf of Mexico Program. A number of states have undertaken coastal restoration through these programs. For example, a study by the Long Island Sound National

Estuary Program identified nitrogen loading as the major contributor to low oxygen conditions; in 1991 Connecticut and New York implemented a nitrogen freeze, putting in place source-control measures such as advanced sewage treatment to reduce nitrogen loadings to the Sound.

The Fish and Wildlife Service has bay/estuary programs in the Chesapeake Bay, Delaware Bay, and Puget Sound. NOAA is focusing efforts in the Chesapeake Bay, Long Island Sound, and Gulf of Mexico.

Coastal Barrier Resource System

A 1990 act of Congress enlarged the Coastal Barrier Resource System by approximately 800,000 acres to include 560 units totaling 1.27 million acres. Within this system, the legislation restricts federal spending and assistance for development, with a goal of reducing damage to natural resources on ecologically fragile barrier islands.

Coastal Monitoring and Assessment Programs

NOAA and EPA are responsible for monitoring coastal waters, and the two agencies recently signed a Memorandum of Understanding to coordinate efforts. Each year, the NOAA National Status and Trends program monitors 70 toxic contaminants from 280 sites. Because concentrations of contaminants vary in different parts of the nation, the EPA Environmental Monitoring and Assessment Program (EMAP) plans periodic samples of specific coastal areas. Sampling is underway in the EMAP Virginian Province, which extends from Cape Henry to Cape Cod.

The NOAA Strategic Assessment Program and EPA coastal programs also compile historical data used in characterizing coastal and marine waters. In 1991 NOAA compiled information on U.S. estuaries, coastal pollution discharges, coastal wetlands, shellfish acreage, and fish kills.

Coastal Science Programs

During the past year, a number of federal agencies sponsored coastal research. The NOAA Coastal Ocean Program focused on estuarine habitats, toxic contaminants, fishery stocks, nutrient overenrichment, and natural hazards such as storm-related winds, waves, and surges. EPA emphasized coastal research on ecological risk assessment. The DOI/Minerals Management Service (MMS) continued a 5-year research effort in cooperation with several universities to explore long-term environmental consequences of offshore oil and gas production. MMS also researched the residual effects of oil spills in coastal wetlands; the effects of wetlands channelization; and continental shelf sand deposits, including the environmental, engineering, and economic aspects of their use as a resource.

The DOI/U.S. Geological Survey conducted studies on coastal and wetlands processes to improve the nation's ability to predict coastal erosion, wetlands loss, coastal pollution, and the location of hard mineral resources. The DOI/Fish and Wildlife Service Wetlands Research Center in Louisiana conducted a coastal wetlands assessment, and the Corps of Engineers developed a wetlands research program and coastal models at its Coastal Engineering Research Center and Waterways Experiment Station in Mississippi.

Coastal Zone Management Program

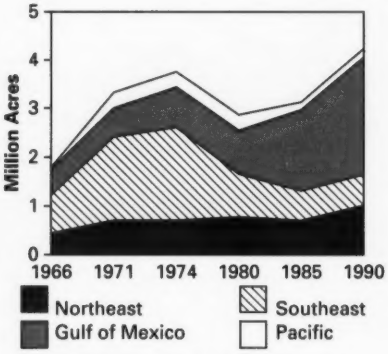
NOAA administers the Coastal Zone Management Act of 1972

Coastal America

This 1991 initiative is an interagency partnership that builds upon the capabilities and authorities of the Army Corps of Engineers, Department of the Interior, Environmental Protection Agency, and National Oceanic and Atmospheric Administration in the Department of Commerce. The Council on Environmental Quality chairs an interagency committee that directs the partnership as it seeks the cooperation of coastal states, other government agencies, and nongovernmental organizations. Coastal America coordinates public and private efforts to address such problems as habitat impoverishment, nonpoint source pollution, and sediment contamination. It encourages development of site-specific, action-oriented projects as well as national education and evaluation efforts.

(CZMA), which calls for federal-state partnerships to promote the wise use and protection of sensitive coastal areas. NOAA offers federal matching grants to coastal states to develop and implement coastal plans that balance coastal development and environmental protection. Presently 29 of the 35 eligible states and territories have federally approved Coastal Zone Management plans, covering almost 95 percent of the total U.S. tidal and Great Lakes shoreline. In 1990 Congress amended CZMA, adding new provisions to be implemented by NOAA and EPA.

Shellfish bed closures.



Source: See Part II, Table 35.

Nonpoint Source Pollution Control. The 1990 amendments require each coastal state to develop a nonpoint source pollution control program subject to NOAA and EPA approval. Both agencies are working on guidelines for such programs, and in June 1991 EPA proposed measures for managing sources of nonpoint pollution in coastal waters, such as agricultural best management practices.

National Priority Grants Program. The 1990 amendments authorize a grants program within NOAA to address eight national coastal priorities:

- Protecting and creating wetlands;
- Reducing risks from coastal natural hazards;
- Increasing public access;
- Reducing marine debris;
- Addressing cumulative and secondary impacts;
- Siting energy facilities;
- Planning ocean management; and
- Developing Special Area Management Plans (SAMPs).

National Estuarine Research Reserve System. Created by CZMA, the National Estuarine Research

National Marine Sanctuaries

Under the 1972 Marine Protection, Research, and Sanctuaries Act, the National Oceanic and Atmospheric Administration may designate discrete areas as national marine sanctuaries to assure protective management of their recreational, ecological, historical, research, educational, and esthetic values. The nation's nine national marine sanctuaries are the marine equivalent of the national parks, harboring an array of marine plants and animals as well as spots for recreational diving and fishing. The Florida Keys National Marine Sanctuary, designated in 1990 as the newest and largest unit in the system, encompasses 2,600 square nautical miles, including the largest coral reef system in the continental United States. A number of areas are under consideration for designation, and the Act is due for reauthorization by Congress in 1992.

National Marine Sanctuaries System

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1991.

Reserve System assists states in acquiring and managing estuarine areas as natural field laboratories. Currently, 19 sites preserve 300,000 acres of estuarine lands and water. In June 1991 NOAA designated the Chesapeake Bay National Estuarine Research Reserve in Virginia as the newest addition to the system. The Chesapeake Reserve, with four sites along the York River, protects nearly 3,000 acres of wetland and upland habitat.

Combined Sewer Overflow Initiative

In 1991 EPA launched an initiative targeting those combined sewer overflow systems causing the most severe water quality problems. EPA will issue new or revised permits to CSO systems lacking or having inadequate discharge permits and will pursue enforcement actions against systems in violation of permit limits.

Damage Assessment and Restoration

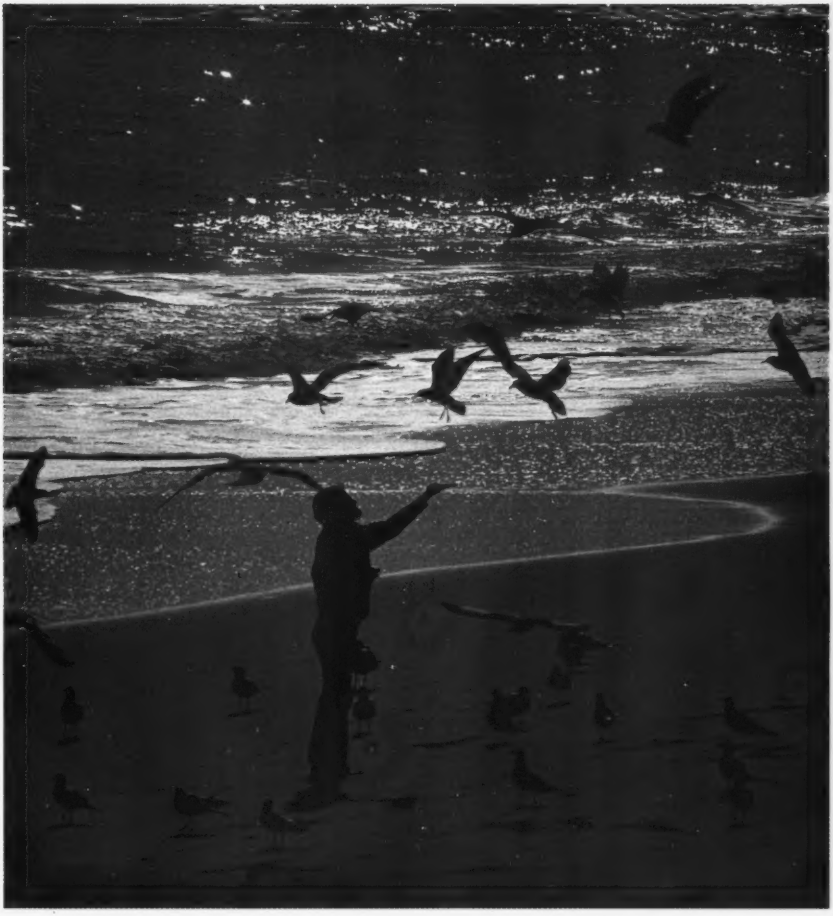
NOAA, DOI, and the Department of Agriculture serve as federal trustees for coastal and marine resources. Working together, they assess damages and economic losses and, with the Department of Justice (DOJ), pursue legal damage claims. In some cases, monies recovered are used to restore damaged resources. The *Exxon Valdez* Damage Assessment Effort, conducted jointly by the State of Alaska, NOAA, DOI, and DOJ led to a record settlement in 1991 that provided $900 million for restoration. The Coastal Wetlands Planning, Protection, and Restoration

National Marine Sanctuaries System.

Marine Sanctuary	Location	Description
1. Channel Islands	Santa Barbara, CA	1,253 square nautical miles of offshore, nearshore, and internal habitats
2. Cordell Bank	San Francisco, CA	397 square miles of ocean waters surrounding a submerged mountain top.
3. Fagatele Bay	Tutuila Island, American Samoa	25 square miles of terraced coral reef ecosystem typical of Pacific islands.
4. Gray's Reef	Sapelo Island, GA	17 square miles of submerged live-bottom coral reef.
5. Gulf of the Farallones	Along the northwest CA coast	948 square nautical miles of diverse habitat for marine mammals and seabirds.
6. Key Largo	Upper Florida Keys	100 square miles of coral reef.
7. Looe Key	Lower Florida Keys	5.32 square miles of the Florida reef tract.
8. *Monitor*	Cape Hatteras, NC	A circular area, one nautical mile in diameter, over the wreck of the *U.S.S. Monitor.*
9. Florida Keys	Upon final designation, it will incorporate Key Largo, Looe Key, and other coral reef areas off FL	2,600 square nautical miles designated by Congress and the President in 1990; an environmental impact statement is being prepared.

Source: U.S. Department of Commerce, NOAA, National Marine Fisheries Service, 1991.

C.J. Badger, Virginia Coast Reserve.



Almost half the U.S. population now lives in coastal counties, placing those ecosystems under increasing pressure.

Act of 1990 authorized projects to protect, restore, or enhance aquatic and associated ecosystems, including wetlands and coastal ecosystems. Among current restoration projects are the following:

Louisiana Coastal Wetlands Restoration Plan. In 1991 the Army Corps of Engineers established an interagency effort to develop wetlands restoration plans.

National Coastal Wetlands Conservation Grant Program. Also in 1991 the DOI/Fish and Wildlife Service initiated a new grant program for wetlands conservation as authorized by the Restoration Act.

Navy Wetlands Restoration. Within the Chesapeake Bay watershed, 37 Department of the Navy installations are taking part in restoration efforts that include the design of a wetlands cre-

ation project to test the effectiveness of using wetlands to reduce nonpoint source pollution, such as stormwater runoff.

Habitat Conservation

The National Marine Fisheries Service (NMFS) in NOAA conducts a National Habitat Protection Program to identify activities that may damage habitats vital to living marine resources. In 1991 NMFS made recommendations to other federal agencies on policies, programs, and projects that could adversely affect up to 300,000 acres of coastal habitat.

Offshore Oil and Gas Moratoria

In June 1990 the nation's outer continental shelf received additional environmental safeguards, when the President placed off-limits for oil and gas development almost all of the West Coast and the southern Florida and New England coast until the year 2000. Energy development will continue in the Gulf of Mexico and parts of the Atlantic and Alaskan coasts. In 1991 the DOI/Minerals Management Service proposed a 5-year plan to implement the President's goals.

Data Collection and Analysis

Gather timely and authoritative information concerning the conditions and trends in the quality of the environment...[and] to analyze and interpret such information...

National Environmental Policy Act, section 204(2)

Also see Mission to Planet Earth, Science and Technology, and related tables and figures in Part II.

To assess the state of the environment, policymakers need credible environmental indicators—statistics or aggregations of statistics used to characterize environmental trends in a meaningful way. Examples of such indicators are population counts of waterfowl, ambient levels of air pollution, and concentrations of dissolved oxygen in streams.

Numerous environmental indicators are in use. *Environmental Trends*, an interagency effort published by the Council on Environmental Quality (CEQ) in 1989, contains over 350 figures and tables based on indicators developed with the following criteria:

- Reflect a meaningful condition or variation in environmental quality;
- Allow for aggregation of data to display national trends as well as disaggregation to show local and regional conditions; and
- Be measurable and of sufficient time series to reveal conditions and trends.

Environmental Trends, with its indicator-based graphics, was chosen for the 1990 Notable Documents List of the American Library Association, which recognizes excellent sources of information.

Despite the work of scientists in and out of government, current environmental indicators are not as comprehensive or meaningful as needed. They tend to be indirect measures, such as discharge quantities or ambient concentrations, rather than more direct measures of ecological or human impacts. Ongoing research will improve the usefulness of environmental indicators and perhaps develop indices—single-value composite indicators—to reflect broad environmental conditions, much as the figure for Gross National Product reflects economic conditions.

Conditions and Trends

Environmental indicators are derived from data collected by research and monitoring programs conducted by numerous public and private organiza-

Environmental Indicators

Decisionmakers use environmental indicators for a number of purposes:

- To identify emerging issues by linking environmental conditions with stress factors;
- To measure risks produced by environmental stress, such as pollution;
- To measure the effectiveness of environmental policies;
- To assist citizens and policymakers in making informed decisions.

tions. Such data should be capable of aggregation or disaggregation into local, national, and international statistics that portray environmental conditions and trends. In practice, however, maintaining a comprehensive monitoring and data management network is difficult. Developing such a network requires coordinating goals, network design, and information management across federal, state, and local agencies and private research organizations. Current management frameworks and inter-organizational cooperation are frequently inadequate to track emerging multimedia environmental problems.

The problem is not hardware, for sophisticated technologies exist to detect and monitor pollutants. Rather, the problem is one of analysis and interpretation—developing the institutional and methodological frameworks needed to collect the right kind of data, to link different types of data, and to translate data into indicators that are useful in making decisions. Several factors need to be integrated in the development of these frameworks:

Multimedia management. While single-media data programs remain valuable, a trend is developing toward cross-program and multimedia data management. Multimedia assessment requires data programs with consistent protocols, methods, and data definitions.

Risk assessment. This emerging discipline quantifies the probability and consequences associated with events that adversely affect the environment. Risk management then ranks environmental risks to assure the most human health and ecological protection for the dollar spent.

Social and economic indicators. The development of indicators also requires linking environmental concerns with social and economic factors. This linkage helps determine underlying pressures on the environment or impacts of pollution control on society.

In 1991 the federal government devoted growing attention to these factors. For example, CEQ convened the Interagency Committee on Environmental Trends to develop frameworks necessary for meaningful environmental analysis in the 1990s and beyond. Congress considered organizational approaches to ensure better integrated statistics in a cabinet-level Department of the Environment; and the National

Academy of Sciences initiated a study on environmental research that includes consideration of the need for a National Institutes of the Environment to conduct comprehensive environmental studies.

Policies and Programs

The federal government conducts numerous environmental data programs, including interagency initiatives that address coordination needs as well as programs that address specific agency missions. In a recent summary, the Environmental Protection Agency (EPA) identified 83 environmental data programs in 25 different federal agencies. Federal funding in fiscal 1991 for statistical programs sponsored by natural resources and environmental agencies alone exceeded $500 million. At the international level, numerous organizations compile data and environmental trends information.

Given this array of environmental data programs, decisionmakers need an overarching framework to help them understand trends that link pressures on the environment, the state of the environment, and policy responses. In 1991 the Interagency Committee on Environmental Trends met to define the priority needs for environmental information in the 1990s. The Committee developed a consensus supporting the following objectives:

- Develop an institutional arrangement to facilitate the interagency sharing of information to improve data availability, compatibility, and quality.
- Develop environmental indicators that enable federal agencies to present statistics in more useful ways.
- Integrate social and economic indicators with environmental information.
- Report environmental trends to support informed decisions by all sectors of society.

Along with efforts to improve data collection, analysis, and interpretation, federal agencies have begun to assess environmental risks, including the costs and benefits of alternative risk management strategies. Consistent benefit and cost estimates across environmental programs could improve regulatory priority setting.

In 1990 the Federal Coordinating Committee on Science and Engineering Technology, within the President's Office of Science and Technology Policy, formed an Ad Hoc Committee on Risk Assessment. This committee is working to harmonize risk assessment approaches among federal agencies. At the agency level, the EPA Science Advisory Board outlined ways for EPA to set priorities based on risk assessments. In 1991 the President's Office of Management and Budget (OMB) launched a Risk Management Budgeting Initiative to assess environmental risks and to analyze policy alternatives in several environment-related areas. As techniques for analyzing environmental data and trends improve, the nation will be in a better position to set environmental priorities.

Federal interagency initiatives to coordinate environmental data and analysis.

Program	Lead agency	Coverage
Interagency Committee on Environmental Trends	CEQ	In 1991 CEQ established an interagency committee with participation of all agencies involved in environmental data to undertake development of environmental information framework.
National Acid Precipitation Assessment Program (NAPAP)	CEQ	NAPAP, established by the 1980 Acid Precipitation Act, coordinates federally funded research and assessment to develop a firm scientific basis for acid rain policies. The Clean Air Act Amendments of 1990 extended NAPAP, which publishes reports on the State of Science and Technology and on Integrated Assessment; NAPAP monitors the influence of the Clean Air Act on environmental impacts.
Environmental Monitoring and Assessment Program (EMAP)	EPA	A long-term monitoring program, initiated in 1988, to provide regional and national assessments of status and trends of U.S. ecological resources. During next 5 years, EMAP monitoring networks will estimate trends in national ecological indicators on a regional basis; monitor indicators of pollutant exposure and habitat condition; seek associations between human-induced stresses and ecological condition; provide periodic statistical summaries and interpretive reports on status and trends for resource managers and the public.
EPA Center for Environmental Statistics	EPA	EPA Development Staff established the Center for Environmental Statistics to gather environmental data from variety of sources, address data quality and statistical issues, and use data to provide information on environmental conditions.
Intergovernmental Monitoring Task Force	EPA and USGS	Established in 1991 by the EPA Office of Water and USGS, coordinating with NOAA, FWS, COE, USDA, OMB, and DOE, the task force identifies and recommends solutions to water quality monitoring problems; establishes a national framework for water quality monitoring; agrees on environmental indicators; and shares water quality data through system linkages and increased quality assurance and control.
Federal Geographic Data Committee (FGDC)	DOI	FGDC, with 14 departments and agencies, promotes coordinated development, use, and dissemination of surveying, mapping, and related spatial data; established by OMB in October 1990 by OMB Circular A-16, "Coordination of Surveying, Mapping, and Related Spatial Data Activities," stressing coordination and standards.

Interagency initiatives, (continued).

Program	Lead agency	Coverage
Ocean Pollution Data and Information Network (OPDIN)	NOAA	A 10-year interagency effort by 11 federal agencies to improve accessibility and usefulness of data and to increase communication and coordination on ocean and Great Lakes pollution information, the Network publishes information guides and responds to requests for information.
FCCSET/CEES/ IWGDMGC	OSTP	Within the President's Office of Science and Technology Policy (OSTP), the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) established the Committee on Earth and Environmental Sciences (CEES) as a forum to coordinate interagency programs, including the U.S. Global Change Research Program (USGCRP). Working with CEES, the Interagency Working Group on Data Management for Global Change (IWGDMGC), is developing recommendations on interagency management of research data. In 1991, the National Research Council drafted a "U.S. Strategy for Global Change Data and Information Management" currently under review.
President's Water Quality Initiative	USDA	Addresses nonpoint source contamination of surface water and groundwater by agricultural chemicals; seven USDA agencies, USGS, NOAA, and EPA compose the Working Group on Water Quality to coordinate efforts, such as National Water Quality Assessment (NAWQA) program created by USGS to assess water quality impacted by pesticides, nutrients, and sediment.
Interagency Advisory Committee on Water Data	USGS	Established by the Secretary of the Interior in 1964, the committee coordinates federal water data programs; chaired by Chief Hydrologist of USGS, represents 30 federal agencies that collect or use water data; six subcommittees are Ground Water, Hydrology (surface water), Sedimentation, Water Data and Information Exchange, Water Quality, and Water-Use Information.

Note: CEQ = President's Council on Environmental Quality; EPA = U.S. Environmental Protection Agency; NOAA = U.S. Department of Commerce, National Oceanic and Atmospheric Administration; OMB = President's Office of Management and Budget; OSTP = President's Office of Science and Technology Policy; USDA = U.S. Department of Agriculture; and USGS = Department of the Interior, U.S. Geological Survey.

Source: CEQ, 1991.

Environmental statistics programs managed by agencies of the U.S. Government.

Program	Sponsor	Coverage	Frequency/ most recent report
Major Uses of Land in the United States	Department of Agriculture (USDA) Economic Research Service	Estimated acreage and inventories of major U.S. Land uses.	Intervals coincide with Census of Agriculture; 1991 report with 1989 data.
National Resources Inventory	USDA Soil Conservation Service	Data on status, condition, trends of soil, water, related natural resources of rural non-federal U.S. land.	5-year cycle; 1989 report with 1987 data.
Forest Insect and Disease Conditions in the United States	USDA Forest Service	Data for federal, state, private forestlands in U.S.; data analyses by region, ownership, type of insect/disease, area affected, dollars lost; trend data available.	Annual collection; 1991 report with 1990 data.
Forest Inventory and Analysis	USDA Forest Service	Inventory with trend information on extent, condition, ownership, and composition of U.S. forests; wildlife habitat, forage production, and other resource characteristics.	Complete inventory on 12-year cycle; 1991 report with 1991 data.
Land Areas of the National Forest System	USDA Forest Service	Data on extent and characteristics of forest, range, and related lands in the National Forest System.	Annual reports.
Tree Planting in the United States	USDA Forest Service	Summary of tree planting in U.S.	Annual reports; 1991 report with 1990 data.
Survey of Pollution Abatement Costs and Expenditures	Department of Commerce (DOC) Bureau of the Census	Annual operating costs and capital expenditures for pollution abatement activities in manufacturing industries.	Annual collection

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
Classified Shellfishing Waters	DOC National Oceanic and Atmospheric Administration (NOAA)	Monitors classified shellfishing waters as indicator of bacterial water quality nationwide; classifies waters for commercial harvest of oysters, clams, and mussels based on actual or potential pollution sources and coliform bacteria levels in surface waters.	Surveys each 5 years; most recent 1990.
Fisheries Statistics Program	DOC/NOAA	National statistics (biological, economic, and sociological) on domestic commercial and recreational fisheries: commercial landings, number of vessels and fishermen, annual processed products; annual world catch of shrimp, shrimp imports, and recreational finfish; saltwater catch.	Daily/monthly/ yearly data collection.
National Climatic Data Center (NCDC)	DOC/NOAA	NCDC collects, processes, archives, and disseminates worldwide meteorological and climatological data from a global network of stations; coverage is global, land and sea, primarily of U.S. dependencies, especially for summarized data.	Responds to over 33,000 user requests per year; records date from mid-nineteenth century to present.
National Data Center (NODC)	DOC/NOAA	NODC collects, processes, archives, and disseminates such worldwide oceanographic data as marine biology, marine pollution, wind and waves, surface and subsurface currents, and temperature.	Responds to over 10,000 user requests per year; records date from late-nineteenth century to present.

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
National Geophysical Data Center (NGDC)	DOC/NOAA	NGDC collects, processes, archives, and disseminates such worldwide geophysical data as solid earth geophysics, earthquake seismology, geomagnetic surveys, marine geology and geophysics, solar-terrestrial physics, and glaciology.	Responds to 11,000 user requests per year; records date from mid-nineteenth century to present.
National Coastal Pollutant Discharge Inventory Program	DOC/NOAA	Compiles pollutant-loading estimates for point, nonpoint, and riverine sources in coastal counties, or 200-mile Exclusive Economic Zone that discharges to the estuarine, coastal, and oceanic waters of the contiguous U.S. excluding the Great Lakes.	East, West and Gulf Coast estimates are for 1982, 1984, and 1987 respectively. In 1992, East Coast will be updated to 1989.
Month and State Current Emissions Trends	Department of Energy (DOE) Argonne National Laboratory	Emissions estimates for NO_x, SO_2, and VOCs by month and state from 1975 to the present for 68 emission source groups.	Monthly; 1975 to present.
National Energy Information Center	DOE Information Administration	Collects and publishes data; prepares analyses on energy production, consumption, prices, and resources; makes projections of energy supply and demand.	Annual reports.
Carbon Dioxide Information Analysis Center	DOE Oak Ridge National Laboratory	Compiles, evaluates, and distributes information related to carbon dioxide (CO_2).	Data collection ranges from hourly to decadal.
Integrated Data Base Program	DOE	Maintains data on all spent radioactive fuel and waste in the U.S.	Annual data collection and reporting.

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
National Wetlands Inventory	Department of the Interior (DOI) U.S. Fish and Wildlife Service (FWS)	Develops comprehensive information on the characteristics and extent of wetlands resources in U.S.; wetlands map coverage for 70 % of lower 48 states, 22 % of Alaska, and all of Hawaii, Puerto Rico, and Guam.	Continuous wetlands trend for lower 48 states; statistical estimates of U.S. wetlands acreage beginning in 1990.
Gap Analysis	DOI/FWS	Develops standardized distribution maps of surface vegetation, terrestrial vertebrates, and endangered species in the lower 48 states and Hawaii.	First analysis, 1988; national assessment to be completed in 1998, to be updated at 5-year intervals.
National Contaminant Biomonitoring Program	DOI/FWS	Documents temporal and geographic trends in concentrations of persistent environmental contaminants that may threaten fish and wildlife; covers major U.S. rivers and Great Lakes.	2- to 4-year intervals.
North American Breeding Bird Survey	DOI/FWS	Provides uniform basis for assessing long-term trends in avian populations throughout North America; total number of individuals by species, survey route, and state.	2-year intervals.
Waterfowl Breeding Population and Habitat Survey	DOI/FWS	Provides annual breeding population estimates; measures breeding habitat changes over major portion of duck breeding range in North America.	Annual surveys and reports.
Statistics and Information Services	DOI/Bureau of Mines	Collects, analyzes, and publishes data on metal production and consumption, including scrap and waste.	Monthly, quarterly, and annually.

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
Public Land Statistics	DOI/Bureau of Land Management (BLM)	Collects summary statistics of land ownership in the United States and BLM natural resource management programs at the geographic state level.	Annual reports.
National Stream Quality Accounting Network (NASQAN) and National Hydrologic Benchmark Network	DOI/U.S. Geological Survey (USGS)	NASQAN provides nationally uniform basis for assessing large-scale, long-term trends in physical, chemical, and biological characteristics of waters; monitors for pH, alkalinity, sulfate, nitrate, phosphorus, calcium, magnesium, sodium, potassium, chloride, suspended sediment, fecal coliform bacteria, fecal streptococcal bacteria, dissolved oxygen, dissolved oxygen deficit, and trace elements; Benchmark Network monitors water quality in surface waters largely unaffected by human activities.	Yearly data summaries for each state.
National Trends Network	DOI/USGS	Monitors deposition under National Acid Precipitation Assessment Program (NAPAP); 150 stations predominantly in rural areas, in combination with USDA National Atmospheric Deposition Program (NADP); more than 200 sites nationwide.	
National Water Conditions Reporting System	DOI/USGS	Collects and analyzes streamflow data, groundwater levels, reservoir contents, and limited water quality data from 5 sites on major rivers.	Published in monthly newsletter, *National Water Conditions.*

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
National Water Use Information Program	DOI/USGS	Determines U.S. fresh and saline surface water and groundwater withdrawn, for what purposes, water consumed during use, and water returned to source after use.	National compilations every 5 years; most recent 1990; next report in 1992.
Water Resources Assessment Program	DOI/USGS	Summarizes statistics on state and national water resources for USGS biennial report, National Water Summary; each report oriented to water resource theme, such as groundwater quality.	Biennial; 1990 report covered water supply and use.
Earth Observing System	National Aeronautics and Space Administration (NASA)	Measures key environmental variables using series of unmanned satellites; part of NASA Mission to Planet Earth program; EOSDIS, a data and information system, will coordinate with the Global Change Data and Information System, a major component of which is the NOAA data and information system.	
National Air Pollution Control Program	Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards	Collects and analyzes data on ambient air quality and air pollution levels and compares them to National Ambient Air Quality Standards (NAAQS).	Annual reports on air quality and emission estimates.
Comprehensive Environmental Response, Compensation and Liability Information System	EPA Office of Emergency and Remedial Response.	Contains information on over 30,000 abandoned or uncontrolled hazardous waste sites.	Updated on-line.
Environmental Radiation Ambient Monitoring System (ERAMS)	EPA Office of Radiation Programs	Monitors radiation in air, drinking water, surface water, and milk.	Sampling intervals from twice weekly to biannual, based on analyses, at 332 stations; since 1973.

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
Hazardous and Non-hazardous Surveys	EPA Office of Solid Waste	Collect data through survey and regulated entity reports on hazardous and non-hazardous ("solid") wastes generation and management; information on regulated entities and waste volumes they generate and manage.	Current data is from 1985 biennial report and two 1986 surveys.
Toxics Release Inventory	EPA Office of Toxic Substances	Mandatory annual inventory of releases of 328 toxic chemicals to air, water, land, and off-site disposal from more than 17,000 manufacturing facilities across the country.	Annual reports.
Water Pollution Control Act [Section 305(b)] Assessments	EPA Office of Water	Compiles state reports on water quality status of surface and groundwater, as required by Section 305(b), Federal Water Pollution Control Act; states prepare assessments using various monitoring data.	1990 biennial report as of 1988.
Ambient Water Monitoring Program/ STORET	EPA Office of Water	Largest database for water quality information; data contained in STORET with over 170 million data points from states and federal agencies, such as USGS, on surface water and ground water quality, sediments, streamflow, and fish tissue contamination.	Updated on-line.
Public Water System Supervision Program	EPA Office of Water	Contains information about public water supplies (PWSs) and their compliance with monitoring requirements, maximum contaminant level (MCL) regulations, and other requirements of the Safe Drinking Water Act; data is stored in the Federal Reporting Data System.	Quarterly state and EPA regional reports.

Environmental statistics, (continued)

Program	Sponsor	Coverage	Frequency/ most recent report
National Pollutant Discharge Elimination System Program	EPA Office of Water	Tracks permit compliance and enforcement status of facilities covered by water pollution permits; information is contained in the Permit Compliance System (PCS).	Monthly facility reports entered on an ongoing basis.
Municipal Construction Program	EPA Office of Water	Inventory of existing or proposed publicly owned treatment works (POTWs) that need construction or renovation to meet Clean Water Act requirements; information is maintained in the Needs Survey System.	2-year update from each state; biennial report submitted to Congress.
Coastal and Ocean Protection Programs	EPA Office of Water	Covers environmental data (water quality, biological, permitting, environmental impact data) for discharges and pollutant loadings to coastal waters as well as ocean dumping; information contained in Ocean Data Evaluation System (ODES).	Biennial reports to Congress for National Estuary Program; annual reports to the Ocean Dumping Program; special reports on coastal programs.

Note: Neither this table nor the source document, which describes 72 federal programs, are exhaustive. For instance, USDA also maintains mission-oriented statistics in such areas as crops, snowpack, soil erosion, national forests management, and wildfires. DOC Bureau of Census maintains social, demographic, and economic statistics relevant to the environment. NOAA maintains statistics on marine resources and coastal wetlands. BLM maintains statistics for BLM lands, including condition, wildlife, minerals, and use; and NPS collects comparable statistics on the status of national parks. The Bureau of Mines collects, interprets, and publishes data on production, consumption, and trade of over 100 minerals. FWS maintains data on FWS lands and conducts surveys of fishing, hunting, and wildlife-associated recreation every 5 years, with the most recent report in 1991. USGS maps national land use and land cover, and EPA conducts regional and other pollution surveys. The Department of Transportation compiles highway and other transportation statistics, and the U.S. Coast Guard maintains data on marine pollution spills.

Source: U.S. Environmental Protection Agency, Center for Environmental Statistics, *Guide to Selected National Environmental Statistics in the U.S. Government (draft)*, (Washington, DC: EPA, 1992).

State of the Environment Reports and Statistical Compendia Published by International Organizations

Commission of the European Communities (CEC)

CEC, *The State of the Environment in the European Community 1986*, (Luxembourg: CEC, 1987). Earlier editions were published in 1977 and 1979.

Eurostat, *Basic Statistics of the Community*, annual (Luxembourg: CEC, 1990).

Eurostat, *Environment Statistics 1989*, annual (Luxembourg: CEC, 1990).

Organization for Economic Cooperation and Development (OECD)

OECD, *Environmental Data Compendium 1991*, (Paris: OECD, 1991). Earlier versions were published in 1984 (pilot), 1985, and 1987.

OECD, *The State of the Environment*, (Paris: OECD, 1991). Previous editions were published in 1979 and 1985.

United Nations

A.L. Dahl and L.L. Baumgart, *The State of the Environment in the South Pacific*, (Geneva, Switzerland: UNEP, 1983).

United Nations Economic and Social Commission for Asia and the Pacific, *State of the Environment in Asia and the Pacific*, (Bangkok: UNESCAP, 1985).

United Nations Environment Programme (UNEP), *Environmental Data Report 1991-92*, biennial (Oxford, England: Basil Blackwell, 1991). This report is coproduced with Kings College, London; the World Resources Institute in Washington, D.C.; and the U.K. Department of the Environment. It was intended to complement the more easily understood *World Resources Report*.

UNEP, *State of the World Environments*, annual (Nairobi: UNEP, 1991). The 1982 and 1987 reports were also published as, respectively, M.W. Holdgate, M. Kassas, and G.F. White, eds., *The World Environment 1972-1982*, (Dublin: Tycooly International, 1982); and E. El-Hinnawi and M.H. Hashmi, *The State of the Environment*, (Guildford, England: Butterworth-Heinemann, 1987).

UNEP, *The State of the Marine Environment: UNEP Regional Seas Programme*, (Nairobi: UNEP, 1990). The following regions were covered for the years indicated: West and Central Africa (1984), East Africa (1980, 1982, 1984, and 1985), Kuwait (1985), South Asia (1985), East Asia (1985), Red Sea and Gulf of Aden (1985), Indian Ocean (1985), and Oceania and the Pacific (1985).

United Nations Statistical Office and United Nations Economic Commission for Europe, *Environmental Statistics in Europe and North America: An Experimental Compendium*, (New York: UNSO and UNECE, 1987).

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World Bank, *The World Bank and the Environment*, (Washington, DC: World Bank, 1990).

World Bank, *World Development Report 1991*, annual, (Oxford, England: Oxford University Press, 1991).

World Resources Institute

A.L. Hammond, ed., *World Resources 1990-1991*, biennial, (Oxford, England: Oxford University Press, 1990). This publication is coproduced with UNEP and the International Institute for Environment and Development.

World Resources Institute, *The 1992 Information Please Environmental Almanac*, (Boston: Houghton Mifflin, 1991).

Source: J. Parker and C. Hope, "The state of the environment: a survey of reports from around the world," *Environment* 34(1):20, (Heldref Publications).

Economics

Promote the improvement of environmental quality to meet the conservation, social, economic, health and other requirements and goals of the Nation...

National Environmental Policy Act, section 204(4)

Also see Budget, Private Sector Initiatives, and related tables and figures in Part II.

Environmental economics is an integrative tool—a science that seeks the optimal balance of costs and benefits of policies that affect the environment. Economists generally approach environmental issues by developing least-cost, market-based approaches to achieve a target level of environmental quality. They suggest target levels of environmental quality by quantifying and, when possible, monetizing the environmental and health benefits of various practices. The application of environmental economics is handicapped, however, by incomplete information about causes and effects of environmental conditions. Economists often face difficulties in measuring environmental changes, natural resource values, and the wellbeing of society. Even so, the use of environmental economics to bring harmony among various goals has continued to grow in recent years.

Conditions and Trends

In the United States and in the increasingly intertwined global economy, large flows of income are associated with the environment. Benefits and costs are spread throughout the economy. For example, industries which earn profits directly from natural resources, such as agriculture, forestry, fisheries, and minerals, account for close to $200 billion in the $5.7 trillion U.S. economy. These direct, quantifiable links between the environment and the economy are augmented by indirect effects, such as the potential loss of crop productivity resulting from air pollution, the ripple-effect of regulatory costs, and the way that environmental issues influence consumer decisions.

Total direct costs of pollution control in the United States, with investments annualized at 7 percent, were estimated to be $115 billion in 1990 (in

Total annualized costs of U.S. pollution control.

Year	1986 Dollars	Estimated 1990 Dollars	GNP*
	billion $		*%*
1972	26	30	0.9
1987	85	98	1.9
1990	100	115	2.1
2000**			
Present	148	171	2.6
Full	160	185	2.8

* GNP=Gross National Product
** Projections at present and full implementation.

Source: U.S. Environmental Protection Agency, *Environmental Investments: The Cost of a Clean Environment*, (Washington, DC, 1990).

1990 dollars) or 2.1 percent of the Gross National Product (GNP). The majority of pollution control expenditures are made by the private sector, with the largest expenditures in the chemical, petroleum, primary metals, food, and paper industries. These expenditures put the United States among the world leaders in the share of its economy spent on pollution control.

The federal government itself spends billions of dollars on resource and environmental management. Direct federal expenditures for fiscal 1991 totaled $18.6 billion, with the largest portion going to pollution control and prevention ($5.9 billion). Funds allocated to the Department of Energy (DOE) and the Department of Defense (DOD) for cleanups of their facilities were an additional $5.6 billion. Tax expenditures are a category of federal spending resulting from mandated tax revenue losses. The largest tax expenditures for environmental purposes in fiscal 1991 were, in the following order:

- Nontaxable treatment of state and local bonds for pollution control and waste management facilities;
- Depletion allowances for some fuel and nonfuel minerals;
- Expensing of private, multiperiod timber growing costs; and the
- Alternative fuel production credit.

The federal government also earns revenues from environmental and natural resources management. In 1991 the government collected over $8.4 billion in revenues from activities such as the following:

- Leasing and extraction of oil, natural gas, timber, grazing, and water resources on federal lands;
- Taxes on chlorofluorocarbons;
- Penalties from oil spill and Superfund prosecutions.

Government receipts more distantly related to federal environmental purposes or natural resources management run into the tens of billions of dollars from sources such as gasoline, diesel, and cigarette taxes.

From the broadest perspective, the environment is influenced by overall macroeconomic conditions. A growing economy may add to pressures on natural resources, but historical experience indicates that such pressures are offset by the additional economic resources that a growing economy provides to address environmental problems.

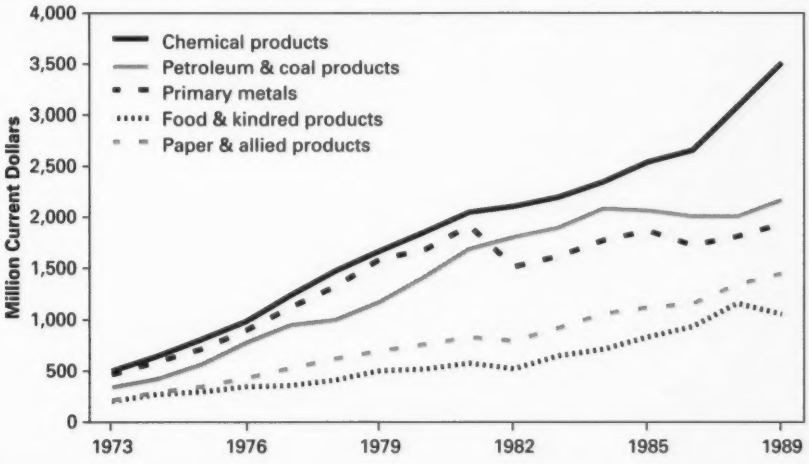
Policies and Programs

The federal government took significant steps in 1991 to integrate economic and environmental policies.

Marketable Allowances for Acid Rain Emissions

Implementing provisions of the 1990 Clean Air Act Amendments, the

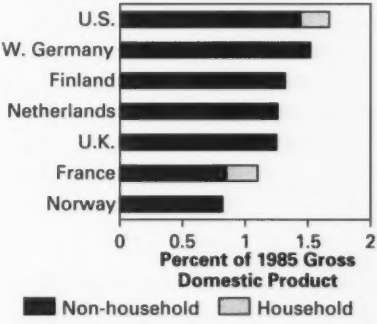
Pollution control expenditures for selected industries.



Source: See Part II, Table 11.

Environmental Protection Agency (EPA) proposed regulations in October 1991 to reduce sulfur dioxide emissions from coal-burning powerplants by almost half by the year 2000. The regulations propose to allocate the reduced quantity of emission allowances to electric utilities and allow buying and selling of those allowances. With such a system in place, utilities with lower control costs will have an incentive to reduce emissions in excess of regulatory requirements and sell remaining emission allowances to those with higher costs. This flexibility will cut the cost of the program by 25 percent or about $1 billion per year—while achieving the same overall reduction in sulfur emissions. Along with the allocation of allowances, detailed provisions mandate the accurate measuring of emissions. During 1991 the Chicago Board of Trade indicated an interest in creating markets for emission allowances, just as rights to metals and agricultural commodities are traded.

U.S. and western European expenditures for pollution control.

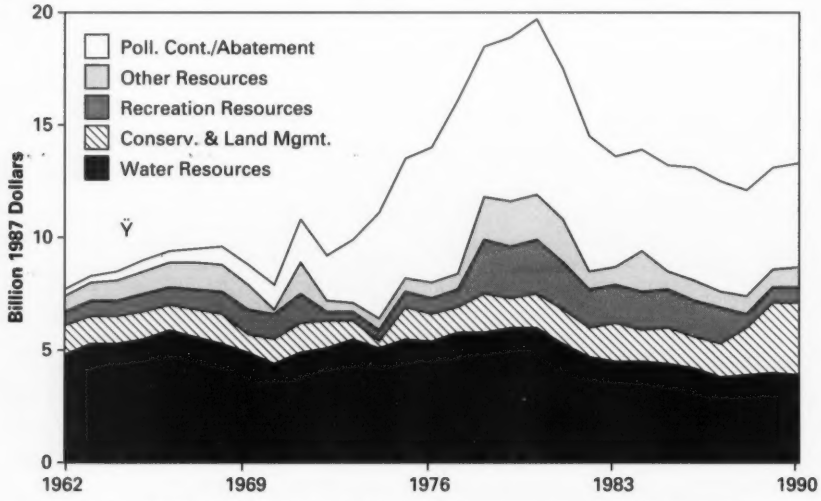


Source: U.U. Environmental Protection Agency, *Environmental Investments: The Cost of a Clean Environment*, (Washington, DC: EPA, 1990).

Fisheries Management Quotas

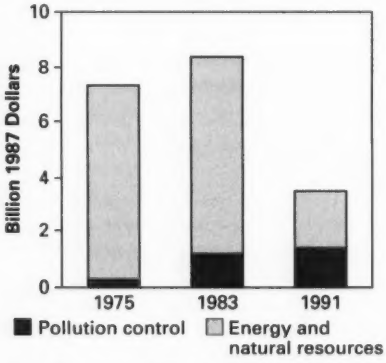
Fisheries managers are using a similar market mechanism to manage economically stocks of surf clams, ocean quahogs, wreckfish, sablefish, and fixed gear halibut fisheries (the latter two pending final approval). Fisheries man-

U.S. federal gross spending for natural resources and environment.



Source: See Part II, Table 12, for a comparison of federal spending for other functions.

U.S. federal tax expenditures for energy, natural resources, and the environment.



Note: Tax expenditures are revenue losses attributable to provisions of the federal tax laws; 1975 data are listed as revenue losses; 1983 and 1991 data are government-outlay equivalents.
Source: Executive Office of the President, Office of Management and Budget, *U.S. budgets for fiscal 1977, 1984, and 1992.*

agement councils and the National Marine Fisheries Service will utilize individual transferable quotas (ITQ) as a means to address the problem of common access to ocean resources, overfishing, and the resulting loss in overall value. In an ITQ system, tradable shares are distributed to private individuals who are given the opportunity to harvest fish within their quota in any manner they choose. The ITQ system reduces overfishing because of an overall cap on quotas. At the same time, it holds down the industry's production costs, since inefficient harvesters will tend to sell their shares to more efficient harvesters. In 1991 the Mid-Atlantic, South Atlantic, and North Pacific Fisheries Management Councils adopted ITQ programs. These programs are not, however, without controversy, since they require allocation or auction of quota amounts among participants.

U.S. federal revenues from major environment-related sources.

Source	1990	1991	1992*
		million $	
Leaking underground storage tanks	122	123	145
Coal mining reclamation	242	243	237
Aquatic resources trust fund	218	260	278
Oil spill liability fund	143	254	283
Sale of minerals	576	573	542
Ozone depletion tax	360	562	662
Sale of power	775	799	838
Sale of timber and other natural land products	1,349	1,042	1,166
Superfund	1,279	1,401	1,190
Outer Continental Shelf leases	3,006	3,151	2,282
Total	8,070	8,408	7,623

*Estimate

Source: Executive Office of the President, Office of Management and Budget, *Budget of U.S. Government*, (Washington, DC: U.S. Government Printing Office, 1992).

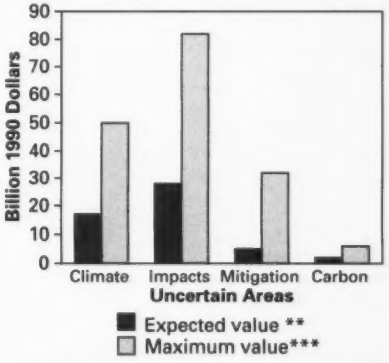
Enforcement of Liabilities

Firm and fair enforcement of existing laws creates incentives to prevent costly liabilities in the future. Fines and payments for the cleanup of hazardous waste sites set new records in 1991. Responsible parties committed over $1 billion in 1991 for the cleanup of hazardous waste sites. EPA collected an additional $61.3 million in civil penalties, an amount equal to 25 percent of all civil penalties collected in EPA history. Cost recoveries for damages to natural resources, previously required under the Superfund law and newly required under the Oil Pollution Act of 1990, also are being pursued in more than 15 cases. Forecasts of compensation from responsible parties range between $10 million and $50 million over the next five years.

Global Change

Economics provides one framework for decisions about whether to act in cases characterized by large scientific uncertainty. Economics research is

Estimated value of global climate information.*



* Potential economic return from early knowledge.
** Represents the best guess at the value of climate change information.
*** Represents the maximum potential of having such information a decade sooner.
Source: W. Nordhaus, *Uncertainties and Research Priorities in Global Environmental Issues*, Testimony before the House Committee on Science, Space, and Technology: Subcommittee on Science, October 8, 1991.

therefore increasingly valuable in the study of global climate change. In 1991 one researcher published his estimates of the value of having natural and social scientific information sooner, rather than later, in four areas of climate change research: climate processes, impacts of climate change, mitigation strategies, and carbon flows and stocks. His work suggested that the value of information is large in all areas but appears to be greatest for the processes and impacts of global climate change.

In addition, in 1991 a U.S. interagency task force studied the optimal design of any policy to address greenhouse gas emissions. The task force concluded that climate policy will be most cost-effective if it addresses all greenhouse gas sources and sinks comprehensively rather than focusing on any one greenhouse gas.

As part of the global climate research program, federal agencies have requested over $17 million in fiscal 1993 for economic research projects. This figure represents a more than 50-percent increase over current funding. Research is targeted at issues such as the economic effects of global climate patterns, global economic models, and uncertainty and the value of information.

Education

Make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment...
National Environmental Policy Act, section 102(G)

Also see Private Sector Initiatives and related tables and figures in Part II.

Environmental literacy is an educational trend of the 1990s. To address the need for environmentally literate citizens of all ages, backed by a solid core of skilled specialists in the environmental sciences, the federal government has undertaken a number of new programs.

Conditions and Trends

Although most states require environmental education in public school curricula, few students receive more than an introduction to environmental science. While some states broadly integrate environmental education into existing curricula, the major effort has been to develop issue-oriented curricula on themes such as energy, water quality, and acid rain.

In the past, environmental science and education were rarely key components of university programs in liberal arts, science, or technical subjects. However, a growing number of institutions have begun to offer specialized degrees in environmental fields at both the undergraduate and graduate levels and to infuse environmental issues into other disciplines. Currently, 1,200 institutions of higher education offer environment-related courses. In the coming years, market forces may attract more people to environmental fields, but in the meantime the nation could experience a near-term shortage of skilled college graduates with training in the environmental professions.

Over 25,000 nonprofit organizations list the environment as a program area. Among these groups, two private organizations have taken a key leadership role in environmental education: the North American Association for Environmental Education, the largest U.S. professional organization in the field with 1,500 members in the United States, Canada, and Mexico; and the Alliance for Environmental Education (AEE, see next page).

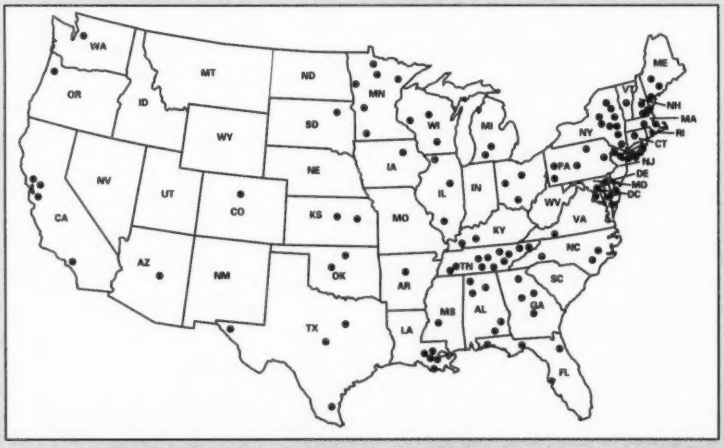
Among other private organizations working to raise environmental literacy are a number of groups that focus on urban and disadvantaged populations.

Centers for Environmental Education

The Alliance for Environmental Education (AEE) sponsors the National Network for Environmental Education with over 100 centers located throughout North America. In a 1991 AEE survey, network centers reported the following annual activities:

- Conducted community outreach programs to 3.4 million people;
- Trained 200,000 teachers in workshops, seminars, and accredited college courses;
- Provided environmental education programs for 700,000 K-12 students;
- Provided services to 1.8 million general public visitors;
- Helped 80,000 visitors at center libraries;
- Responded to 160,000 requests for information;
- Distributed 1 million newsletters, reaching a readership of 5 million;
- Shared information and programs with more than 40 nations.

National Environmental Education Network.



Source: Alliance for Environmental Education, *1991 Center Survey*, (Manassas, VA: AAEE, 1991).

For example, the Earth Corps in Seattle and the Dolphin Defenders in St. Louis operate at the neighborhood level to involve urban youth in environmental programs.

Policies and Programs

Environmental education programs received a boost with passage of the National Environmental Education Act of 1990 (NEEA). NEEA calls for greater collaboration between the federal government and schools, museums, libraries, parks and recreation facilities, the media, and private industry. The Act will help coordinate and augment ongoing environmental education programs in a number of federal departments and agencies.

Department of Agriculture

The USDA Cooperative Extension Service promotes environmental education through 74 universities and 3,200 county and city offices. Projects range from one-on-one training for farmers to wetlands educational materials. The USDA Forest Service sponsors Smokey the Bear fire prevention campaigns and Woodsy Owl environmental education programs for all age groups.

Department of Defense

DOD promotes environmental education and training through Joint Service schools, Military Service training courses and programs, and the Service Academies. DOD technical training centers and institutions offer opportunities to both military and civilian environmental managers.

Department of Education

The Department of Education sponsors the Eisenhower Program to help meet the national goal set by President Bush and the 50 state governors to make the United States best in the world in math and science by the year 2000. Environmental science is a component of these efforts.

Department of Energy

To encourage the study of science and math, DOE is developing partnerships between its national laboratories and local school districts. Teachers and honor students have the opportunity to work in DOE national labs, and scholarships are available for undergraduate and graduate studies in environmental and energy-related fields. DOE sponsors the "New Explorers" television show and an annual Science Bowl. DOE national environmental research parks, such as the one at Oak Ridge, Tennessee, serve as centers for environmental education.

Department of Health and Human Services

The HHS/Public Health Service educates the public on environment-related health issues through publications and media announcements. Public Health Service grant programs support pre- and post-doctoral studies, in addition to summer internships for high school students and teachers.

Department of the Interior

DOI environmental education programs include hands-on learning and research in living outdoor laboratories provided by the nation's public lands. National parks, national wildlife refuges, and fish hatcheries provide interpretive and educational programs to millions of visitors each year. The National Park Service (NPS) has introduced a Learning Laboratories Program, in which selected sites serve as mentor

National Environmental Education Act

The National Environmental Education Act of 1990 (NEEA) updated a 1970 law that targeted elementary and secondary schools exclusively. The new legislation expands federal educational programs to all ages. The Environmental Protection Agency (EPA) is the lead agency for implementing provisions of the Act, which include the following:

- **Task Force.** In accordance with the Act, EPA has established a Federal Task Force on Environmental Education to coordinate programs. Representatives of 16 federal agencies attended the first meeting of the task force in June 1991. Among its duties, the task force will advise the new EPA Office of Environmental Education.

- **Office of Environmental Education.** Established by NEEA, this office coordinates national and international efforts of government agencies and private organizations. A National Environmental Education Advisory Council of primary, secondary, and college educators, nonprofit organizations, the business community, and state departments of education and natural resources will help ensure balanced, relevant, and cost-effective educational programs. In 1991 the EPA Office of Environmental Education assisted in establishing the National Environmental Education and Training Foundation.

- **National Environmental Education and Training Foundation.** This nonprofit foundation, authorized by NEEA, will facilitate contributions of private gifts to environmental education projects. Working with other governments, the foundation will further environmental education and training worldwide.

- **Grants.** NEEA provides for a new program of grants of up to $250,000 to support promising environmental projects sponsored by higher edu-

parks to share their success with other parks. In a new "Parks as Classrooms" initiative, NPS proposes to transport thousands of school children to parks to help them learn about the nation's natural and cultural wonders. To help publicize the need to protect wildlife, the Fish and Wildlife Service (FWS) created a cable television program for elementary school children entitled, "A Home for Pearl." FWS also sponsors school tours at national wildlife refuges and cosponsors a "Suitcase for Survival" traveling education program to familiarize young people with protected wildlife.

To strengthen science education, DOI conducts teacher workshops and develops materials for classroom presentations on specific land management topics. For example, the Bureau of Land Management offers public education programs to inspire good stewardship and sportsmanship. DOI also works with colleges to encourage women and minorities to enter the science fields.

NEEA, (continued).

cation and nonprofit research institutions. Smaller grants for local projects will make up 25 percent of the program. EPA recently issued a grant to the University of Michigan to create a Pollution Prevention Center to develop curricula for graduate engineering, business, and natural resources programs.

• **Clearinghouse.** NEEA calls for a new data clearinghouse to provide educators accurate information accessible through such networks as ECONET and the Environmental Education Centers operated by the private Association of Environmental Educators.

• **Internships.** A new NEEA internship program will place up to 250 interns and 50 fellows per year in environment-related positions within the federal government.

• **Awards.** EPA will administer an NEEA awards program with the following categories:

— The Theodore Roosevelt Award for an outstanding career in environmental teaching or administration;

— The Henry David Thoreau Award for an outstanding contribution to literature on the natural environment and environmental pollution problems;

— The Rachel Carson Award to print, film, or broadcast media for public education and information on environmental issues or problems; and

— The Gifford Pinchot Award for an outstanding contribution to education and training in forestry and natural resources management, including multiple use and sustained-yield land management.

Council on Environmental Quality

CEQ coordinates federal agency ex officio participation in the National Environmental Education and Training Foundation, created by NEEA. A Congressionally chartered, non-profit organization, the Foundation will use both public and private funds to further the goal of an environmentally literate population and workforce in the United States and abroad.

In 1991 CEQ coordinated preparation of the U.S. National Report for the United Nations Conference on Environment and Development (UNCED) to be held in Brazil in 1992. Planned for distribution at UNCED, the U.S. report devotes one chapter to an in-depth discussion of environmental education in America.

Environmental Protection Agency

In addition to efforts as the lead agency for implementing the National Environmental Education Act, EPA conducted a number of other environmental education programs in 1991.

Internships. EPA has cooperative education agreements with 64 colleges

President's Environmental Youth Awards Recipients, 1991.

Recipient	Location	Project
Ipswich Middle School Student Environmental Group	Ipswich, Massachusetts	Students Against Vandalizing the Earth (SAVE): glass recycling.
Nazia Quraishi	Bayonne, New Jersey	Cleaning Up Oil Spills in Our Waterways: environmental remediation.
Justin Kingery	Bob White, West Virginia	Environmentally Safe and Recyclable Products: developed human hair fertilizer.
McDonald Elementary School Science Club	Mohawk, Tennessee	Create an Energy Calendar: use of recycled products.
Eric Champlin	North Canton, Ohio	Adopt-a-Barn-Owl: endangered species conservation.
Holy Cross High School	New Orleans, Louisiana	Project F.U.R. (Fight Urban Runoff): pollution prevention.
Schuyler FFA Chapter	Schuyler, Nebraska	Earth Care Because We Care: conservation and recycling
Kids Organized to Protect Our Environment (KOPE) Club	Salt Lake City, Utah	Campaign to rescue a historic creek—restoring it from a dump to a natural park.
Mililani Uka Elementary School	Mililani Town, Hawaii	Earth Day, Every Day: rainforest conservation.
Mountain View Elementary School	Anchorage, Alaska	Project Need: waste reduction and recycling.

Source: U.S. Environmental Protection Agency, 1991.

and universities under which 200 students per year work in EPA regional offices and laboratories as part of a formal degree program.

- **Federal Junior College Fellowship Program.** This EPA fellowship program presents annual awards to 150 students for work-study toward bachelor or associate degrees.
- **National Network for Environmental Management Studies.** This EPA program supports graduate students through master and doctoral research in areas of priority concern in environmental science, policy, and management. In the past three years, the Network has funded 190 projects or fellowships at 40 universities.

J. Nestingen, Tufts University Environmental Literacy Institute.

Educators are strengthening environmental literacy at all levels of learning from elementary schools to universities.

Awards. EPA administers the Presidential Environmental Youth Awards. Through this annual awards program, the President honors young people for launching projects that improve the environment.

International agreements. During 1991 EPA participated in consultations for a trilateral agreement on environmental education to be signed by the United States, Canada, and Mexico.

Conferences. Among a number of recent conferences on environmental education, EPA sponsored the following:

- **First International Youth Environmental Action Forum.** Co-sponsored by the National Governors Association and EPA, the forum met in May 1990. With support from the departments of Energy, Agriculture, Interior, and the National Oceanic and Atmospheric Administration (NOAA), and private industry, high school students from 19 countries and 47 states met for three days to exchange information and develop action plans for projects in their local communities.
- **National Environmental Education Conference.** Sponsored by EPA in November 1991, the conference explored ways to build partnerships in environmental education. Representatives of key interest groups compared programs and evaluated new federal plans.

National Aeronautics and Space Administration

NASA aeronautic centers, such as the Kennedy Space Center and Wildlife Refuge in Florida, provide environmental education at the community level. Additional education projects include a NASA handbook on weather satellites

for high school teachers, Ph.D. fellowships in the area of global change, and a data clearinghouse.

National Oceanic and Atmospheric Administration

Since 1966 the NOAA Sea Grant Program has supported over 10,000 students in training and education in the marine sciences and marine affairs. During 1991 some 400 graduate students conducted research at Sea Grant colleges funded by NOAA. Since 1979, under the NOAA Sea Grant Fellows Program, 168 students have trained at federal agencies and congressional offices in Washington, D.C. Sea Grant colleges, through an advisory service and communications programs, also reach thousands of adults each year with information on concerns about ocean and Great Lakes resources.

National Science Foundation

NSF focuses on undergraduate environmental education in math, science, engineering, and technology. NSF also assists middle schools and high schools in developing environmental education curricula.

Peace Corps

The Peace Corps works with colleges and universities to offer internships to U.S. students who work in developing nations in environmental fields such as water sanitation and forestry. Returning Peace Corps volunteers possess a wealth of knowledge about conditions in developing countries that often is tapped and brought into U.S. schools.

Tennessee Valley Authority

A TVA Center for Environmental Education has branches at 16 regional colleges and universities. The branches focus on teacher training, developing programs on natural resources and environmental issues, public outreach, and research. Linked by a telecommunications system called ECONET, the branches have electronic mail and a data clearinghouse. The Alliance for Environmental Education has adopted ECONET as a national prototype. Working with the Air and Waste Management Association and EPA, TVA has co-produced a teacher's guide on air quality. Plans for "Land Between the Lakes," a 170,000-acre TVA research and training area, include an international training center to bring together corporate and international leaders and to house an exchange program with educators from the Commonwealth of Independent States (the former Soviet Union).

U.S. Agency for International Development

Environmental quality is a key concern in the humanitarian aid and other funds provided to foreign governments by the U.S. Agency for International Development. The Peace Corps and AID are incorporating environmental issues into a new Natural Resources Management program.

United States Information Agency

USIA uses communications channels such as its Voice of America radio broadcasts, Worldnet Television service, publications, exhibits, and expert speakers to elevate environmental consciousness on an international level and to share U.S. solutions to environmental problems. In 1991 the Environmental Action in America Exhibit, on display in a number of foreign countries, emphasized the responsibility of individuals in shaping the environment.

Energy

Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities...
National Environmental Policy Act, section 101(b)(5)

Also see Science and Technology, Transportation, and related tables and figures in Part II.

In 1991 energy issues were especially prominent in developments affecting international security, economic growth, and environmental quality. The United States led international efforts to liberate Kuwait following the Iraqi invasion, events which had major repercussions for the world energy economy. The Bush Administration also issued its National Energy Strategy (NES), began implementation of the 1990 Clean Air Act Amendments, and hosted the opening session of negotiations toward an international framework convention on global climate change. Combined with greater Congressional activity affecting energy and the environment, these initiatives point to significant changes in the way the United States obtains and uses energy.

Conditions and Trends

The U.S. pattern of energy use is commensurate with a high standard of living, large land area, low population density, and abundant, relatively inexpensive energy resources. Compared with citizens of other nations, Americans have greater personal mobility, greater space in homes and offices, more single-family homes, better heating and cooling systems, and a wider range of labor-saving appliances.

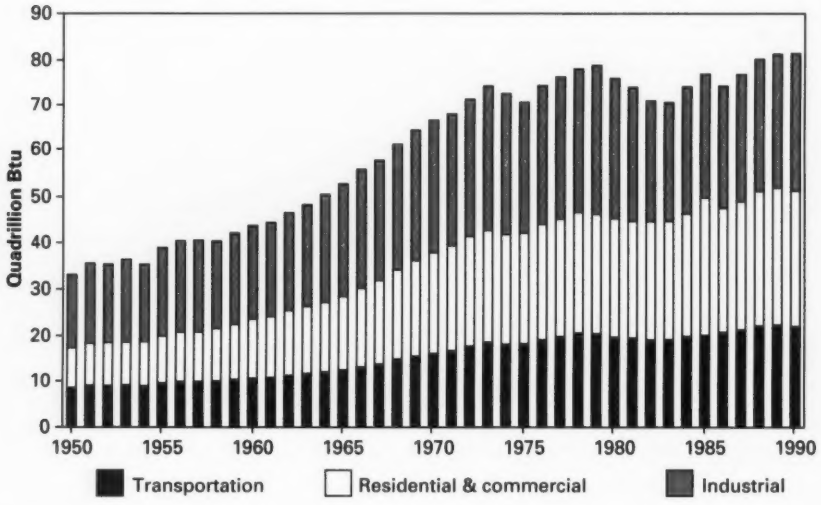
Energy Consumption

Energy is needed to produce goods and services in the following four basic economic sectors:

Residential. The abundance of single-family homes and the relatively small size of U.S. families, combined with a higher standard of living, cause energy use per dwelling to be the highest in the world. Heat for rooms and hot water accounts for more than half of home energy use; major appliances account for about 20 percent.

Commercial. Electricity supplies nearly 70 percent of the energy used by this sector. Much of the growth in national electricity use can be attributed to increasing use of air-conditioners in

U.S. energy consumption, by end-use sector.



Source: See Part II, Table 23.

commercial buildings, which partly reflects population growth in the nation's Sunbelt.

Industry. Industry accounts for more than one-third of national energy consumption, relying on a mix of fuels. Nine energy-intensive industries, including steel, paper, and chemicals, account for 70 percent of this use. Petroleum and natural gas are the major industrial fuels, together accounting for roughly three-fourths of direct consumption.

Transportation. More than one-quarter of U.S. energy consumption is devoted to the transport of people and goods. Virtually all of this energy consists of petroleum products used to power automobiles, trucks, ships, airplanes, and trains. In all, the transportation sector accounts for about two-thirds of petroleum use in the United States.

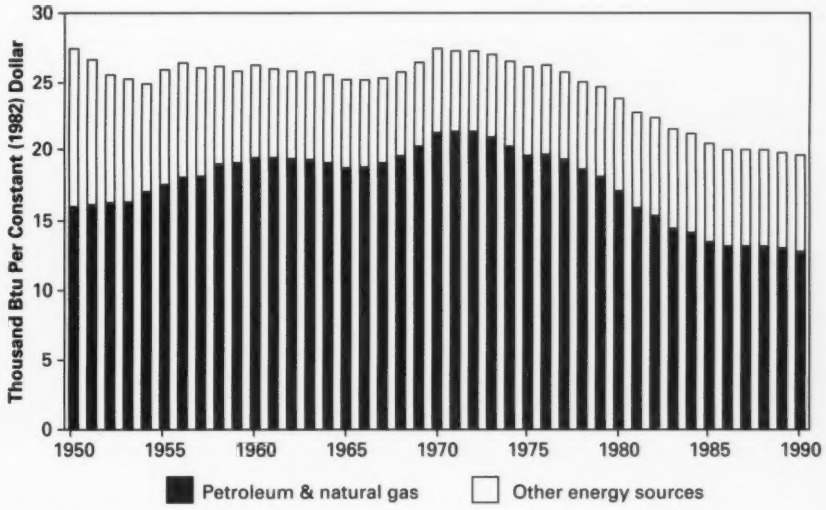
Over the past two decades, Americans have learned to use energy more efficiently in every sector. The United States uses about 10 percent more energy today than it did in 1973, yet there are 30 percent more homes, 50 percent more vehicles, and the gross national product is 50 percent higher. By comparison, U.S. energy consumption more than doubled from 1949 to 1973. Since 1973 energy-related emissions have been relatively stable or declining as new technologies and cleaner fuels replaced dirtier, less efficient ones.

Of significant concern, even with increased energy efficiency and conservation, is the Department of Energy (DOE) projection that the United States will require a great deal of new electric generating capacity by 2010—in the range of 175 to 325 medium-sized powerplants.

Energy Production

U.S. domestic energy resources are extensive and diverse; coal, oil, natural gas, and uranium are all found in significant quantities within U.S. borders.

U.S. energy consumption, per dollar of GNP.



Note: GNP= Gross National Product
Source: See Part II, Table 25.

Renewable energy sources such as the sun and wind are available in quantities limited only by the economics of technologies to harness them.

Petroleum. Production of crude oil and refined products accounts for about one-fourth of U.S. annual energy production. Over 40 percent of the crude oil used in the United States is imported—much of it from politically volatile regions of the world such as the Persian Gulf, which holds nearly two-thirds of known global oil reserves.

Natural gas. Natural gas accounts for approximately one-fourth of all U.S. annual energy production. Natural gas reserves are found in several areas of the United States, and supplies are generally transported by pipeline to consumers.

Coal. American coal reserves are the largest in the world, supplying nearly one-fourth of all U.S. energy consumption. Almost nine-tenths of domestic coal use is for electricity generation at large power stations.

Nuclear. Nuclear power supplies about 20 percent of all U.S. electricity generation. In 1991 no new nuclear powerplants were scheduled for construction, beyond those already underway primarily because of regulatory uncertainty, economics, and concern over nuclear waste disposal and safety issues.

Renewables. Renewable sources, which include hydropower, solar, biomass, wind, and geothermal energy, currently provide almost 10 percent of U.S. annual energy production. Although more than half of this goes to electricity generation, with hydropower the leading source, biofuels are used for transportation, and solar energy heats buildings and hot water.

Electricity. As an energy source, electricity is clean, easily transported and used. However, the amount of raw

energy (coal, nuclear, oil, or gas) consumed to generate electricity is much greater than the amount of energy finally produced. Coal currently provides more than 55 percent of U.S. electricity; most of the remainder is produced by nuclear, hydropower, and natural gas.

Environmental Impacts

The environmental impacts of energy production and consumption are far-reaching and diverse. Coal and nuclear energy are the two most problematic energy sources; coal combustion produces air emissions including particulates, sulfur dioxide, nitrogen oxides, trace metals, and carbon dioxide, while nuclear power production raises concerns about radioactive emissions and solid wastes. Solid and hazardous wastes generated by all energy industries are associated with such problems as contamination of groundwater by leaching from disposal ponds and landfills; release of toxic substances into the air; and surface water contamination from spills and runoff. Energy and environmental statutes enacted since the 1970s have significantly reduced the adverse impacts of energy production and use.

Policies and Programs

During the past year, President Bush introduced two major energy initiatives—a National Energy Strategy and an Executive Order on Federal Energy Management.

National Energy Strategy

Issued by the President in February 1991, the National Energy Strategy (NES) seeks to achieve roughly equal measures of new energy production and conservation. A summary of major NES provisions appears in the box on the facing page and a discussion of current energy issues follows.

Arctic National Wildlife Refuge. The National Energy Strategy calls for oil and gas development under strict environmental safeguards in a small portion of this wildlife refuge in northeast Alaska. The area of exploration, approximately 1.5 million acres out of 19 million acres total, could contain between 3.6 billion and 8.8 billion barrels of oil. By way of comparison, the oil field at nearby Prudhoe Bay, Alaska, contains 10 billion barrels. ANWR also serves as the second largest wildlife refuge in the United States, harboring a unique and diverse arctic ecosystem. Legislation to permit oil and gas exploration in ANWR, subject to stringent environmental safeguards, has been considered in recent sessions of Congress, but competing claims about energy and environmental priorities have blocked a resolution of the debate.

Energy impact assessments. A NES initiative would require federal agencies to conduct energy impact assessments for all major rulemakings and Administration legislative proposals that significantly affect energy supply and demand. Such analyses would be conducted as part of the existing regulatory review process required under Executive Order 12291. They would become a requirement in the preparation of an acceptable Regulatory Impact Analysis.

Energy wastes. In 1991 Congress began work on reauthorization of the Resource Conservation and Recovery Act (RCRA), which governs the handling of solid wastes. One issue is whether wastes from coal-fired powerplants and oil and gas development activities should be categorized as hazardous wastes subject to regulation under RCRA Subtitle C. Under the

National Energy Strategy

In February 1991 President Bush issued a National Energy Strategy (NES) to lay the foundation for a more efficient, less vulnerable, and environmentally sustainable energy future. In barrel-of-oil equivalents, NES initiatives will provide roughly equal measures of new energy supplies and increased conservation. With maximum reliance on markets as a keystone of the strategy, NES initiatives address five interlocking areas:

- **Energy security.** When fully implemented, NES will make the nation less prone to economic damage from sharp fluctuations in either the supply or the price of petroleum.

- **Energy and economic efficiency.** NES initiatives aim to lower energy costs to consumers, reduce energy-related emissions, maintain or enhance standards of living, and promote a strong economy.

- **Energy supplies.** To secure future energy supplies, NES will develop and use renewable energy sources; increase reliance on low-emission energy sources such as natural gas; develop a new generation of safer nuclear technology; and continue development of domestic coal and oil supplies in an environmentally responsible manner.

- **Environmental quality.** Initiatives will increase the efficiency of energy-producing and consuming technologies, reduce solid and hazardous wastes, and improve energy-related practices.

- **Technology and competitiveness.** NES initiatives fortify the nation's foundations in science and engineering research, technology development, and education; establish federal research and development priorities; strengthen research in universities, industries, and international collaboratives; accelerate technology transfer from federal laboratories to private industry; and enhance U.S. mathematics, science, technology, and engineering education.

The Strategy complements such developments as the 1990 Clean Air Act Amendments, natural gas price decontrol in 1989, incentives provided to domestic energy producers in the fiscal 1991 budget agreement, international cooperation forged during the recent Persian Gulf crisis, and the Secretary of Energy's science and mathematics education initiatives.

In 1991 Congress considered a range of energy legislation, from comprehensive packages designed to implement the Strategy to others focused on specific concerns. Comprehensive bipartisan bills including new production and conservation measures were considered in committee but action was not completed by the full Senate or House in 1991.

U.S. renewable energy consumption.

Sector and source	Consumption		
	1988	1989	1990
		quadrillion Btu	
Residential, commercial, industrial			
Biofuels*	3.09	2.83	3.23
Hydropower	0.03	0.03	0.04
Geothermal	0.13	0.14	0.16
Ocean thermal	0.00	0.00	0.00
Solar energy			
Thermal	0.09	0.09	0.08
Photovoltaic	0.00	0.00	0.00
Wind	0.03	0.03	0.04
Transportation			
Biofuels			
Alcohol fuels**	0.06	0.07	0.08
Electric utilities			
Biofuels***	0.02	0.02	0.02
Hydropower	2.64	2.88	2.94
Geothermal	0.22	0.20	0.18
Ocean thermal	0.00	0.00	0.00
Wind	****	0.00	****
Total renewable energy	6.31	6.29	6.70

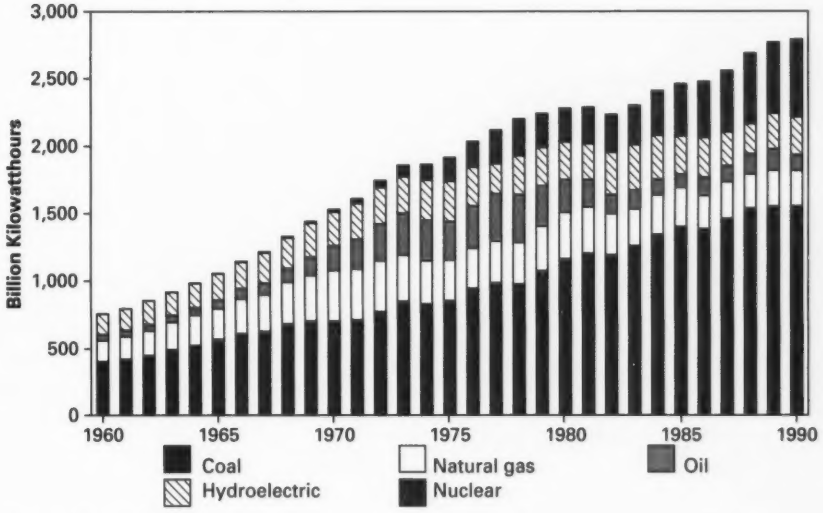
* Includes wood, landfill, and sewer gas, municipal solid waste, and waste heat from biomass sources.
** Includes ethanol and methanol produced from biomass sources.
*** Includes electricity generation from utility wood and waste plants.
**** Less than 0.005 quadrillion Btu.

Source: Energy Information Administration, *1990 Annual Energy Outlook: With Projections to 2010*, (Washington, DC: EIA, 1991), Table 104, page 237.

1980 RCRA amendments, Congress temporarily exempted these wastes from regulation pending further study by the Environmental Protection Agency (EPA). EPA submitted reports to Congress in 1987 and 1988, concluding that such regulation is not warranted.

Global climate change. Despite large uncertainties regarding potential global climate change, credible scientific concern exists regarding the climatic impacts of the buildup of heat-trapping "greenhouse" gases in the atmosphere. Energy use and production are estimated to contribute 57 percent of the emissions related to potential global climate change. Consistent with the 1990 report of the United Nations-sponsored Intergovernmental Panel on Climate Change, the United States has begun to implement cost-effective programs that will reduce or restrain greenhouse gas emissions and provide a number of other benefits. For example, by combining measures required under the 1990 Clean Air Act Amendments with NES initiatives to boost energy efficiency and increase the competitiveness of renewable energy sources and nuclear power, projected greenhouse gas emissions can

Sources of U.S. electricity.



Source: See Part II, Table 20

be cut substantially. For further discussion, see the International Issues section.

Integrated Resource Planning (IRP). To meet growing electricity demand, utility managers and state regulators traditionally have used economic cost comparisons to select the next powerplant addition. Energy conservation measures that accommodate growing demand with fewer negative environmental side effects have received less attention, in part because they usually result in depressed revenues to the utility.

IRP is an increasingly popular way to ensure that utilities and state regulators evaluate all the costs and benefits of supply- and demand-side options and choose the most cost-effective option. The net result is likely to be additional state incentives for energy conservation and efficiency investments. To implement NES support for integrated resource planning, the Department of Energy will expand programs to provide accurate information and analytical tools to consumers, utilities, and state regulators. DOE also will promote IRP by the federal power marketing administrations, which supply power in various regions of the country. The Department will work with the Federal Energy Regulatory Commission (FERC) to foster IRP through FERC regulation of wholesale power markets.

Nuclear waste disposal. In 1987 Congress designated Yucca Mountain in southern Nevada to be considered for a permanent nuclear waste repository. Such a site is needed for the permanent safe disposal of the spent nuclear fuel and high-level radioactive wastes generated by commercial nuclear powerplants. In 1991 successful litigation permitted resumption by DOE and the U.S. Geological Survey of scientific studies of the site to determine its

hydrologic and geologic characteristics, including the potential for such natural hazards as volcanism, faulting, and earthquakes. The studies are expected to take at least ten years to complete, and a final site selection will not occur until after the studies are completed. In 1991 the Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency (EPA) continued to cooperate on development of federal standards and requirements for the management and disposal of spent nuclear fuel and high-level radioactive waste.

Federal and state efforts continued during 1991 toward development of disposal facilities for low-level radioactive wastes in accordance with the Low-Level Radioactive Waste Policy Amendments Act of 1985. Under this act, states are responsible individually or through interstate compacts for developing new disposal facilities for low-level wastes generated within their borders. DOE and NRC are providing technical assistance to the state agencies responsible for developing and regulating the new disposal facilities. In addition, NRC increased regulatory efforts in 1991 to compel cleanup of existing radioactive contamination at licensed nuclear materials sites.

Offshore oil and gas. In June 1990 President Bush set a new course for energy development activities on the nation's outer continental shelf (OCS). The President's decision placed off-limits for leasing until the year 2000 almost all of the West Coast as well as the coasts of southern Florida and New England. His decision endorsed continued consideration of activities in the Gulf of Mexico and parts of the Atlantic and Alaska coasts. In 1991 the DOI/Minerals Management Service took public comments and proposed a second draft 5-year plan to implement the President's goals in the period from mid-1992 to mid-1997. The proposed program includes increased efforts to gather environmental and resource information and to respond to the views expressed by states, local governments, and the public. For most planning areas, less acreage will be offered for leasing.

Oil pollution. For a discussion of oil pollution, see the Transportation section of this report.

Research and development. Research, development, and application of advanced technology are crucial in meeting the nation's energy, environmental, and economic goals. The National Energy Strategy emphasizes three areas of technology development:

- Diversifying fuel choices in the transportation sector;
- Developing domestic energy resources in an environmentally protective manner; and
- Increasing the efficiency of energy generation and consumption and the range of clean, economical technology choices.

Coal quality studies conducted by the U.S. Geological Survey are essential in addressing acid rain and acid mine drainage concerns. Such studies determine whether a specific coal deposit is suitable for direct burning, gasification, contaminant removal through cleaning procedures, or coal-bed methane production. Knowledge of these factors allows the nation to increase use of coal—an abundant, inexpensive domestic resource—in an environmentally acceptable manner.

Transportation fuel efficiency. The National Energy Strategy seeks to improve the efficiency of vehicles on the road and to increase the overall effi-

Outer Continental Shelf (OCS) leasing studies and proposals.

Region and planning area	Planned studies	Proposed easing
Alaska Region		
Gulf of Alaska		
Yakutat	Yes	1995
Middleton	Yes	No
Kodiak	Yes	No
Cook Inlet	Yes	1994
Shumagin	Yes	No
Aleutian Arc	No	No
North Aleutian Basin	Yes	No
Bowers Basin	No	No
Aleutian Basin	No	No
Norton Basin or Navarin Basin or St. Matthew Hall	Yes	1996
Hope Basin or St. George Basin	Yes	1995
Chukchi Sea	Yes	1994,1997
Beaufort Sea	Yes	1993,1996
Atlantic Region		
North Atlantic	Yes	No
Mid-Atlantic and South Atlantic	Yes	1994,1997
Straits of Florida	No	No
Gulf of Mexico Region		
Eastern Gulf		
North of 26°	Yes	1994,1997
South of 26°	Yes	No
Central Gulf	Yes	Annually
Western Gulf	Yes	Annually
Pacific Region		
Southern California	Yes	After 1/1/96
Central California	Yes	No
Northern California	Yes	No
Washington-Oregon	Yes	No

Note: Data is as of July 1991. Actual dates of proposed leasing depend on the outcome of the Area Evaluation and Planning Process.

Source: U.S. Department of the Interior, Minerals Management Service, *Proposed Comprehensive OCS Natural Gas and Oil Resource Management Review, 1992-1997,* (Washington, DC: DOI/MMS, July 1991).

ciency of the U.S. transportation system. For example, the Strategy would expand efforts to develop such technologies as gas turbines, electric vehicles, fuel cells, intelligent vehicle-highway systems, high-speed trains, and advanced air traffic control systems.

The Department of Energy and the Department of Transportation currently are implementing measures to improve public transportation services, encourage use of carpools and vanpools, and increase public awareness of more efficient driving and commuting habits.

DOT is sponsoring a study by the National Academy of Sciences on corporate average fuel economy (CAFE) standards for automobiles, considering safety, technology, regulatory requirements such as those in the Clean Air Act, and the state of the automobile industry. If warranted by the NAS study, changes in current standards will be considered along with incentives to ensure that the transition occurs in a cost-effective manner.

Water quality. The National Energy Strategy would ensure that activities associated with energy production and use protect surface and groundwater resources. Pending congressional action to reauthorize the Clean Water Act could affect the energy industry in a number of ways. Issues include compliance with and enforcement of water quality standards, pollution prevention, enhanced protection of wetlands and coastal areas, nonpoint

source pollution, groundwater protection, and above-ground storage tanks.

Executive Order on Federal Energy Management

The Executive Order on Federal Energy Management, signed by President Bush in April 1991, has three elements:

- Energy use in federal buildings must be reduced 20 percent below 1985 levels by the year 2000;
- Gasoline and diesel use in government fleets of 300 or more vehicles must be reduced 10 percent below 1991 levels by 1995; and
- All federal agencies must procure the maximum practicable number of alternative-fuel vehicles by the end of 1995. The federal government plans to bring 3,125 alternative-fuel vehicles into the federal fleet in fiscal 1992 and over 5,000 such vehicles by the end of fiscal 1993.

The goals of the Executive Order go well beyond the requirements of existing laws and will save American taxpayers up to $800 million in annual energy costs. Federal energy consumption will be cut by the equivalent of up to 100,000 barrels of oil per day.

Enforcement

[make available] comments and views of the appropriate Federal, State, and local agencies which are authorized to develop and enforce environmental standards...

National Environmental Policy Act, section 102(C)

Also see National Environmental Policy Act and related tables and figures in Part II.

Since passage of the National Environmental Policy Act of 1969, the trends in environmental law enforcement have been toward more criminal enforcement, greater self-reporting within the regulated community, and increased overall federal enforcement activity. In 1991 these trends, which continued undiminished, were supplemented by the emerging trends of market incentives and multimedia enforcement.

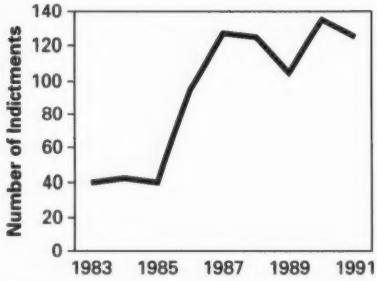
Conditions and Trends

The past year was the third consecutive recordbreaking year for environmental enforcement. Recent trends show increases in criminal indictments, fines, restitution, and forfeitures, as well as civil recoveries in terms of penalties, settlements, cost recoveries, and injunctive relief. The deterrent effect of such efforts likely will increase, as the Pollution Prosecution Act of 1990 authorizes the addition of up to 200 civil and criminal investigators through 1995. Other recent statutes, including the Oil Pollution Act of 1990 and the Clean Air Act Amendments of 1990, increase the range and limits of civil and criminal penalties.

The October 1991 settlement over the Exxon Valdez oil spill in Alaska's Prince William Sound was the largest environmental settlement in history. The Exxon Corporation and Exxon Shipping Company agreed to pay over $1 billion in criminal fines and civil damages. Their criminal fines and payments for remediation and restoration totaled $150 million ($25 million suspended)—six times more than the total in criminal fines recovered by the federal government since the Department of Justice (DOJ) established an environmental crimes unit in 1982. The federal government and the state of Alaska also agreed to act as co-trustees over a 10-year period to restore natural resources affected by the spill.

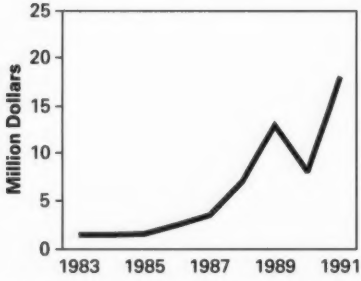
Historically most environmental enforcement has been media-specific, focusing on air *or* land *or* water in specific locations. However in 1991 the

Federal indictments for environmental crimes.



Source: U.S. Department of Justice, Environmental Crimes Division, Washington, DC, 1991.

Federal fines collected for environmental crimes.



Source: U.S. Department of Justice, Environmental Crimes Division, Washington, DC, 1991.

federal government continued a move toward multimedia initiatives linking enforcement actions under several statutes to address violations adversely affecting more than one environmental medium. For example, in July 1991 DOJ and the Environmental Protection Agency (EPA) joined forces to file 36 enforcement actions against major sources of lead emissions under six environmental statutes, including the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund).

Because of the vast number of potential prosecutions, the government has an interest in encouraging greater self-auditing and policing by regulated entities. In 1991 DOJ announced an environmental audit policy stating that the Department will view such voluntary actions as mitigating factors in the exercise of enforcement discretion. Responding to the concern that aggressive enforcement might deter voluntary self-audits and disclosure, the policy describes the factors DOJ considers in bringing criminal prosecutions.

Other enforcement priorities are collecting compensation for natural resource damages, identifying violations that pose the greatest risks to human health and the environment, and increasing the use of pollution prevention tools in enforcement settlements. EPA describes these approaches to enforcement in two 1991 documents: *Enforcement Four-Year Strategic Plan* and *Enforcement in the 1990s Project.*

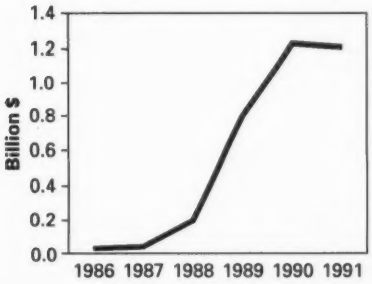
Policies and Programs

Despite gains in environmental enforcement, the issues of the 1990s require aggressive and innovative approaches. The following are highlights of enforcement actions recorded in 1991.

Clean Air Act

While the Clean Air Act Amendments of 1990, when fully implemented, will enhance the enforcement tools available to EPA and DOJ, vigilant enforcement of its statutory requirements continued in 1991. For example, in February 1991, a steel corporation was named in a complaint citing coke

Dollar value of federal environmental enforcement actions.



*Includes civil penalties, settlements, cost recoveries, and injunctive relief; for the latter, data is not available prior to 1988.
Source: U.S. Department of Justice, Natural Resources and the Environment Division, Washington, DC, 1991.

oven batteries for alleged noncompliance with the Clean Air Act and the Pennsylvania State Implementation Plan.

Clean Water Act

The first, second, and fourth largest civil penalties to date for Clean Water Act violations were imposed in 1991. These penalties are attributable in part to an EPA settlement policy emphasizing the requirement that amounts recovered are to be higher than the amounts a polluter would save by violating the law. On the criminal side, in the second conviction for knowing endangerment under the Act, a health industry executive was found guilty of four felony violations for dumping 51 vials of

Year in Review in Environmental Enforcement

In 1991 environmental enforcement efforts included the following:

- Judicial enforcement actions returned $25 for every dollar spent.
- Environmental criminal enforcement returned $3 in fines, restitution, and forfeitures for every dollar spent.
- For the third straight year, the value of civil, administrative, and judicial enforcement efforts by EPA and DOJ exceeded $1 billion.
- EPA and DOJ filed 154 Superfund cases and 340 civil enforcement cases, both all-time records.
- Persons convicted of environmental violations served 91 percent of the jail time imposed.
- Recoveries for natural resource damages rose from $23 million in 1990 to $45 million.
- Civil penalties totaled a record $32.5 million.

Federal administrative enforcement actions, by environmental law.

Fiscal Year	CAA	CWA/ SDWA	RCRA	CERCLA	FIFRA	TSCA	EPCRA	TOTAL
1972	0	0	—	—	860	—	—	860
1973	0	0	—	—	1,274	—	—	1,274
1974	0	0	—	—	1,387	—	—	1,387
1975	0	738	—	—	1,614	—	—	2,352
1976	210	915	0	—	2,488	0	—	3,613
1977	297	1,128	0	—	1,219	0	—	2,644
1978	129	730	0	—	762	1	—	1,622
1979	404	506	0	—	253	22	—	1,185
1980	86	569	0	0	176	70	—	901
1981	112	562	159	0	154	120	—	1,107
1982	21	329	237	0	176	101	—	864
1983	41	781	436	0	296	294	—	1,848
1984	141	1,644	554	137	272	376	—	3,124
1985	122	1,031	327	160	236	733	—	2,609
1986	143	990	235	139	338	781	0	2,626
1987	191	1,214	243	135	360	1,051	0	3,194
1988	224	1,345	309	224	376	607	0	3,085
1989	336	2,146	453	220	443	538	0	4,136
1990	249	1,780	366	270	402	531	206	3,804
1991	137 *	1,745 **	364	269	300	422	179	3,416

* Does not include asbestos demolition and renovation data.
** Does not include SDWA data.

Note: CAA = Clean Air Act; CWA/SDWA = Clean Water Act/Safe Drinking Water Act; RCRA = Resource Conservation and Recovery Act; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act (Superfund); FIFRA = Federal Insecticide, Fungicide, and Rodenticide Act; TSCA = Toxic Substance Control Act, EPCRA = Emergency Planning and Community Right to Know Act (Title III, Superfund Amendments and Reauthorization Act of 1986).

Source: U.S. Environmental Protection Agency, FY 1991 *Enforcement Accomplishments Report*, (Washington, DC: EPA, 1991).

contaminated blood into the Hudson River and the New York Bay.

Enforcement Training

EPA is developing multimedia training courses for its compliance inspectors, program, and legal staff, which will be offered under the umbrella of the National Enforcement Training Institute. The institute was created to provide enforcement training to EPA, state, and local personnel involved in environmental enforcement.

Hazardous Waste

Federal enforcers continued to bring cases under the CERCLA or RCRA to deter noncompliance and to clean up waste sites. Highlights of recent actions include the following:

- The federal government reached a $77 million settlement with a wood-treating company to clean up its Superfund site in California;
- A corporate president pleaded guilty to knowing endangerment under RCRA, the first such plea ever;

- A large paper company agreed to a $2.2 million criminal fine under RCRA for illegal treatment and storage of hazardous waste.

Natural Resource Damage Recoveries

A growing enforcement priority is the recovery of natural resource damages for environmental harm. The *Exxon Valdez* criminal and civil settlement is by far the largest natural resource damages recovery in U.S. history, but it is not the only one. For example, the federal government reached a consent decree with the city of Seattle for a $24 million restoration of natural resources harmed by the release of hazardous substances in Elliott Bay and the lower Duwamish River. In a polychlorinated biphenyl (PCB) contamination case, two companies agreed to reimburse the United States and the Commonwealth of Massachusetts $12.6 million for the cleanup of New Bedford Harbor and the resulting natural resource damages.

Increasing Criminal Prosecutions

The Administration continues to treat the violations of environmental laws as seriously as other criminal offenses. In a number of recent legislative reauthorizations, the Administration proposed and Congress approved raising the criminal penalties provided in the statutes. DOJ has also been working with the U.S. Sentencing Commission to ensure that sentencing guidelines for environmental defendants provide penalties as strong as those for other lawbreakers.

Protection of Federal Property

After several years of litigation, the United States and the State of Florida settled a 1988 lawsuit in which the federal government alleged that the Florida Department of Environmental Resources and the South Florida Water Management District delivered polluted, nutrient-rich water to the Everglades National Park and the Arthur Marshall Loxahatchee National Wildlife Refuge, resulting in damage to their fragile and unique ecosystems. Under the settlement, federal and state officials will take the following actions:

- Impose strict interim and long-term limits on the amount of nutrients permitted to flow into the Everglades and Loxahatchee ecosystems;
- Ensure that the Everglades ecosystem gets the correct amounts of water at the proper times;
- Set a timetable to create at least 35,000 acres of large flow-through treatment marshes designed to treat all agricultural drainage flowing into the Everglades;
- Establish Best Management Practices in the Everglades Agricultural Area to control nutrients; and
- Conduct research and monitoring programs.

Transboundary Pollution

An international enforcement strategy is emerging in response to the transboundary nature of environmental issues. In 1991 the United States brought the first criminal prosecutions in the world for violations of international rules governing transport of hazardous wastes. The Administration also brought the first enforcement actions in the world against violators of rules to phase out substances that deplete the Earth's ozone layer. The United States and Mexico responded to environmental problems along their border by training investigative personnel, establishing a compliance tracking system, and form-

ing a working group to focus on enforcement in the region.

Wetlands Protection

EPA and the Army Corps of Engineers continue to take enforcement actions against persons who destroy or adversely affect wetlands in violation of section 401 of the Clean Water Act. For example, in April 1991, two brothers were indicted on five Clean Water Act counts in Pennsylvania for development activity that resulted in the destruction of 54 acres of wetlands. On the civil side, enforcement cases continue to rise at a rate of 25 percent per year.

Wildlife and Fisheries

In 1991 prosecutions of violations found by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) resulted in 1,200 indictments or informations, 900 pleas or convictions, 60 years of actual jail time, and $1 million in fines. U.S. Coast Guard fisheries enforcement for 1991 provided NMFS with 1,522 fisheries-related violation reports. DOJ emphasized migratory bird violations, particularly where massive deaths resulted from flights into open-air toxic waste ponds. One of the first civil injunctive actions under the Endangered Species Act forced an irrigation district to reduce intake levels on a water diversion system during the downstream migration of an endangered salmon species to protect the fish. DOJ obtained over $3 million from the forfeiture of vessels involved in fishing violations in 1991.

Federal Facilities Management

Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have had an impact on man's environment...

National Environmental Policy Act, section 102(A)

Also see Pollution Prevention and related tables and figures in Part II.

As the United States wages a national campaign to protect the environment, federal facility managers are exploring ways not only to clean up their own polluted sites but to prevent pollution through innovative management and procurement.

Conditions and Trends

With passage of the Resource Recovery Act of 1970, federal emphasis began to shift from waste disposal to the recycling of materials and conversion of waste into energy. While the Resource Conservation and Recovery Act of 1976 (RCRA) expanded the earlier legislation, the results of previous pollution-producing practices remained. The 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) and its 1986 amendments provided for the emergency cleanup of the worst hazardous waste sites, including those located on federal facilities. In 1991 the Superfund National Priorities List (NPL) included 116 federal sites.

Pollution Prevention

In the late 1970s federal recycling efforts faltered as markets for recycled products failed to develop, but today, the rising costs of waste disposal have rekindled a national interest in recycling. Goods and services purchased by federal, state, and local governments equal 20 percent of the gross national product. Through their purchasing power, federal facilities are developing markets for recycled products. RCRA directed the Environmental Protection Agency (EPA) to implement guidelines for federal procurement of recycled materials, including paper products and other goods.

The Federal Energy Management Improvement Act of 1988 requires all federal agencies to reduce energy consumption by 10 percent by 1995 based on 1985 energy consumption levels.

U.S. budget for cleanup of federal facilities.

Federal facility	1989 Actual	1992 Enacted	1993 Proposed	1992-1993 Change Dollar	Percent
			million $		%
Department of Energy	1,762	4,407	5,534	+1,127	+26
Department of Defense	1,155	2,761	3,718	+957	+35
Department of Agriculture	8	38	39	+1	+3
Department of the Interior	41	70	80	+10	+14
Department of Transportation	29	54	59	+5	+9
NASA, DOJ, and DOC	28	41	58	+17	+41
Total	3,023	7,371	9,488	+2,117	+29
DOD 1992 anticipated supplemental	—	1,034	—	N/A	N/A

Source: Executive Office of the President, Office of Management and Budget, *Budget of the U.S. Government*, (Washington, DC: U.S. Government Printing Office, 1992).

Executive Orders

During 1991 President Bush signed two executive orders whose goals go beyond existing legislation in targeting federal facilities management:

Federal Energy Management. The April 1991 Executive Order on Federal Energy Management has three elements:

- Energy use in federal buildings must be reduced 20 percent below 1985 levels by 2000;
- Gasoline and diesel use in federal fleets of 300 or more vehicles must be reduced 10 percent below 1991 levels by 1995;
- All federal agencies must procure the maximum practicable number of alternative-fuel vehicles by the end of 1995.

The goals of the Executive Order will save taxpayers up to $800 million in annual energy costs, and federal energy consumption will be cut by the equivalent of up to 100,000 barrels of oil per day.

Waste Reduction and Recycling. In October 1991 President Bush signed an executive order requiring each federal agency to reduce wastes and increase recycling by taking the following actions:

- Initiate a program to promote cost-effective waste reduction and recycling of reusable materials in operations and facilities;
- Procure more items made from recycled materials, in accordance with RCRA.

The order also establishes a Council on Federal Recycling and Procurement Policy to develop guidelines and help coordinate agency waste reduction and recycling efforts.

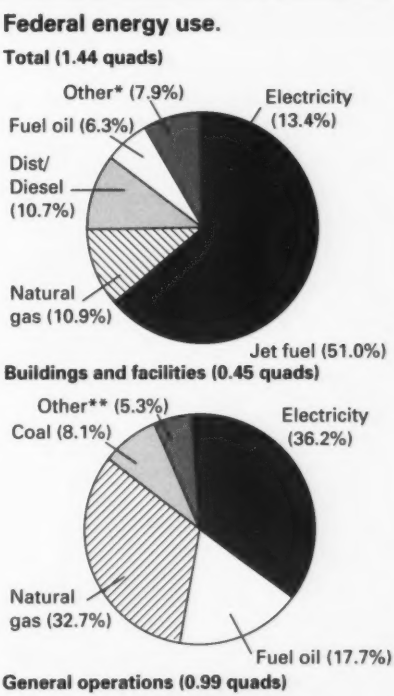
Pollution Control

The Department of Defense (DOD) and the Department of Energy (DOE) lead in numbers of federal facilities on the National Priorities List, although agencies such as the Department of the Interior, Department of Transportation, and General Services Administration are also cleaning up NPL sites. EPA and the states are working with federal facilities on environmental remediation and restoration.

Department of Defense. Of 17,989 military sites with potential hazardous waste contamination, 11,200 sites remain in need of remediation. Only 94 of these sites qualified for the National Priorities List. DOD proposes to commence all required remedial actions by the year 2000. Despite overall defense budget reductions, the fiscal 1992 budget designated $2.6 billion for DOD environmental programs—an increase of $1 billion from 1990 funding.

Department of Energy. The Department of Energy has managed the U.S. nuclear weapons program for over 30 years. In January 1991 DOE issued the Nuclear Weapons Complex Reconfiguration Study, with plans to consolidate and modernize existing facilities. The changing world situation has led to agreements to destroy or deactivate hundreds of nuclear weapons, making the nuclear complex of the future smaller, less diverse, and less expensive to operate than existing facilities. The nation will be able to maintain and modernize some stockpiles while disposing of others. The DOE Reconfiguration Study includes plans for constructing and operating the new complex in compliance with federal, state, and local environmental laws. As required by the National Environmental Policy Act, DOE is preparing an environmental impact statement (EIS) to

Federal energy use.



*Includes auto gas, Navy Special fuel, purchased steam, coal, Lpg/propane, and aviation gas (non-jet).
**Includes purchased steam, Lpg/propane, and other fuels such as renewable energy sources.
***Includes Navy Special, Lpg/propane, aviation gas, and other fuels such as renewable energy sources.

Note: Data is for 1990. Conversion factor for electricity is 3,412 Btu per Kilowatt hour.
Source: U.S. Department of Energy, *Annual Report to Congress on Federal Government Energy Management and Conservation Programs, Fiscal Year 1990,* (Washington, DC: DOE, 1991), page 7.

analyze consequences of alternative complex configurations, with an EIS-completion date set for 1994.

In August 1991 DOE issued the second update of its Environmental Restoration and Waste Management Five-Year Plan, an annual compliance guide for cleanups scheduled at 17 DOE sites in 13 states. The goal is to achieve cleanup and compliance by the year 2019. The DOE environmental restoration and waste management budget grew from $2.3 billion in fiscal 1990 to $4.2 billion in fiscal 1992.

Policies and Programs

The following are efforts by federal facilities to prevent pollution in the future and to clean up existing pollution.

General Services Administration

The General Services Administration (GSA) is the lead agency in the federal recycling effort. In response to an EPA study whose findings indicated that 90 percent of waste in a typical federal office consists of paper products, GSA established the Federal Recycling Program in 1990 to unify federal agencies in source reduction, collection, procurement, and marketing. The program is also available to state and local governments and to private industry. The GSA policy requires recycling in government-owned or operated buildings when required by local or state laws or in buildings with 100 or more employees in localities with markets for recyclable material.

In late 1990 GSA announced the expansion of conservation efforts to the purchase and use of recycled goods. The Federal Supply Service, the procurement agency within GSA, is purchasing recycled paper and insulation, retread tires, recharged and recycled toner cartridges for laser printers, small copiers, and microphotographic equipment.

United States Postal Service

In 1991 the United States Postal Service (USPS) introduced an integrated environmental initiative to improve management of its facilities nationwide. Internal policy directives cover waste reduction, pollution prevention, and recycling, and, as part of the initiative, the agency has added new environmental management positions, regional oversight committees, and a steering committee. Programs include the following:

National Recycling Program. Launched in September 1991, the USPS National Recycling Program is projected to save 600,000 tons of wastepaper, cardboard, wooden pallets, plastics, and aluminum annually. Among the most extensive national programs, this effort could save up to $40 million a year.

Reducing bulk mail. USPS works with business mailers to improve the effectiveness of direct marketing. As a result, in fiscal 1990 and 1991, bulk business mail was reduced by 1.4 billion pieces.

Recycled materials. To emphasize the environmental benefits of recycled materials, USPS is using recycled paper and water-based inks in the printing of stamps. Today all postal cards are printed on recycled paper, and bulky materials are being replaced in express and regular mail.

Safer products. The Postal Service is sponsoring research to find safer products such as totally water-soluble adhesives or re-pulpable labels. The agency is working with industrial counterparts to perfect a recyclable cellulose

material, as a replacement for plastic envelope windows.

Trip reduction. Managers of a pilot trip-reduction program in Los Angeles plan to eliminate 35 percent of the employee vehicles arriving at postal sites affected by poor air quality.

Department of Defense

Initiatives are underway to improve environmental management on DOD's 25 million acres of federal lands and facilities. For example, pursuant to a November 1991 agreement, EPA evaluated forestry and land management practices on DOD installations, and is preparing a joint publication with DOD on "The Feasibility of Enhancing the Management of Forests and Vegetation on DOD Lands."

Environmental Management Study. In October 1990 DOD initiated the Defense Environmental Management Study (DEMS) to recommend an environmental strategy. The 85-member team from the Army, Air Force, Navy, Marines, DOD defense agencies, Office of the Secretary of Defense, and Office of the Inspector General proposed compliance with federal, state, and local environmental laws by December 1993. Military installations will attempt to reduce solid waste disposal by 10 percent for each of the next five years, beginning in 1992, and reduce hazardous waste 25 percent from 1992 levels by 1995. DEMS is reviewing military specifications and standards involving hazardous materials and proposes to identify risk-reducing alternatives by December 1993. This is also the date set for implementing community outreach plans. To achieve these goals, the DEMS team recommended a pollution prevention program to include federal contractors, a network of environmental training and technical centers to promote environmental careers, and support for the types of research and development needed by federal facilities. Based on the study, DOD submitted its first long-range (10-year) environmental strategy to Congress, setting priorities for compliance, restoration, and resources stewardship.

Life Cycle Costing

The General Services Administration is exploring environmentally conscious products, such as energy-efficient washing machines and freezers. Using a technique called life cycle costing, GSA adjusts the original price of such products to reflect projected energy efficiency and other factors, such as labor, replacement components, and cost after disposal. During the past two years, GSA has purchased energy-efficient products that, over their lifetime, could represent savings of $904,000.

Environmental Response Task Force. The 1991 National Defense Authorization Act called for the cleanup of U.S. military bases slated for closing, and in April 1991, the Secretary of Defense created the Defense Environmental Response Task Force. The task force has representatives from the EPA, GSA, Department of Justice, the National Association of Attorneys General (representing the states), and the Environmental and Energy Study Institute (representing public interest groups). In October 1991 the task force reported on measures to expedite cleanups such as land-use transfers, cleanup processes, regulations, and funding.

Alternative-Fuel Vehicles

The Alternative Motor Fuels Act of 1988 requires federal agencies to purchase the maximum number practical of alternative fuel vehicles (AFVs). The federal government plans to bring 3,125 AFVs into its fleet in fiscal 1992 and over 5,000 such vehicles by the end of fiscal 1993. Led by the Postal Service, which operates the nation's largest fleet of alternative-fuel delivery vehicles, federal agencies already have purchased a number of AFVs that use the following fuels:

- **Methanol flexible fuel.** GSA and DOE purchased 65 methanol flexible fuel sedans from Ford Motor Company and General Motors. The cars operate on methanol, unleaded gas, or any combination of the two, and are in use in Los Angeles, San Diego, Detroit, and Washington, DC.
- **Compressed natural gas (CNG).** USPS will expand its fleet to over 1,000 CNG vehicles in 1992. GSA and DOE purchased two prototype CNG 8-passenger vans from the Chrysler Corporation that are now in use in Washington, DC; another 50 vans are scheduled for delivery in spring 1992.
- **Ethanol flexible fuel.** GSA has purchased 25 ethanol flexible fuel sedans that operate on ethanol, unleaded gasoline, or any combination of the two.
- **Electric-powered vehicles.** USPS will begin testing electric-powered vehicles in 1993.

Department of Energy

DOE also must balance national defense with environmental protection in the management of its federal facilities.

Contractor accountability and performance. To protect the environment, worker safety, and public health, DOE has modified criteria for awarding contract fees to management and operating (M&O) contractors. Under a June 1991 rulemaking, M&O contractors at DOE sites will be accountable for avoidable costs resulting from negligence or willful misconduct on the part of the contractor or subcontractor personnel.

DOE is using environmental restoration management contractors to clean up radioactive and hazardous contamination at its federal facilities. Remediation contractors will manage site investigation, cleanup, decontamination, and decommissioning. DOE currently is reviewing public comments on a July 1991 notice for a contractor to manage restoration at its Fernald, Ohio, site. This will be the first DOE site at which an environmental restoration contractor will manage an entire cleanup process, instead of the current practice of facilities management and operating contractors overseeing the cleanup efforts of environmental subcontractors. DOE is also preparing a programmatic environmental impact statement to analyze potential environmental consequences of cleanup and

United States Postal Service.

The United States Postal Service leads the nation in the number of alternative-fuel delivery vehicles in current use.

compliance at all of its sites, with a completion date set for 1993.

Epidemiological initiatives. DOE is restructuring its epidemiology program to promote worker safety and public health, with assistance from a standing committee of the National Academy of Sciences on epidemiological research. DOE established a data repository to organize epidemiological records of past and present workers, with data available to qualified researchers.

Compliance and cleanup agreements. Enforceable agreements with state and federal regulators assist DOE in setting compliance and cleanup schedules. The agreements address noncompliance with environmental requirements as well as cleanup of active and inactive DOE facilities and sites. Since the first agreement in 1979, DOE, EPA, and the states have executed approximately 75 agreements.

Sovereign immunity. Although one federal agency may not sue another federal agency, waivers to sovereign immunity allow EPA and the Department of Justice to enforce U.S. environmental laws on federal facilities through such mechanisms as enforceable agreements. In 1991 DOE took part in con-

gressional review of proposed legislation that would amend RCRA to expand the sovereign immunity waiver to cover fines, penalties, and administrative orders.

Hazardous and mixed wastes. DOE has the technology and capacity to comply with RCRA requirements for managing purely hazardous wastes, but the same cannot be said of mixed wastes—wastes that have both a radioactive and hazardous component. RCRA requires that certain mixed wastes be treated to reduce their potential for migration prior to land disposal. The law also prohibits storing such wastes except to accumulate sufficient quantities for recovery, treatment, or disposal. However, treatment technology and capacity do not yet exist for much of the radioactive mixed waste managed by DOE. Proposed RCRA amendments would establish an enforceable national compliance plan to guide development of adequate treatment technology and capacity for mixed wastes. Affected states would consult on the development of such a plan, which would be subject to EPA approval.

Fisheries and Marine Mammals

Attain the widest range of beneficial uses of the environment without degradation...

National Environmental Policy Act, section 101(b)(3)

Also see Coasts and Oceans, Wetlands, and related tables and figures in Part II.

Living marine resources are one of the nation's most valuable natural assets. From the Bering Sea to the Gulf of Mexico, U.S. waters support an abundance of sea life unparalleled in the world. This richness translates into multi-billion dollar returns each year, but populations of many marine species are declining as a result of overfishing, bycatch waste, and habitat degradation.

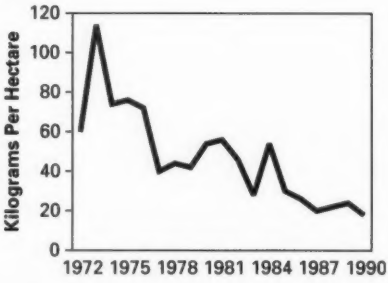
Conditions and Trends

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) in the Department of Commerce, the Fish and Wildlife Service (FWS) in the Department of the Interior, and the Coast Guard in the Department of Transportation share stewardship of anadromous fish and living marine resources in the Exclusive Economic Zone that extends from 3 to 200 miles off U.S. coasts. Within this two million square mile area, the largest of any nation, commercial fishermen in 1990 landed 9.7 billion pounds of fish and shellfish with a dockside value of $3.6 billion. In addition, the U.S. industry exported a record $2.8 billion of edible domestic fishery products in 1990. Marine recreational fisheries annually involve 17 million anglers who spend over $7 billion in direct purchases and create an additional $12 billion in indirect economic activities. U.S. consumers in 1990 spent $26.7 billion on seafood purchases and consumed an estimated 15.5 pounds of seafood per capita. Subsistence fishing, aquaculture, and recreational viewing, such as whale watching, also provide economic benefits.

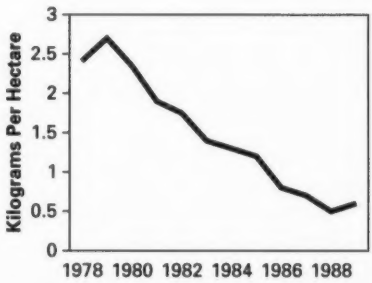
Despite their value, populations of most marine species off the Atlantic, Pacific, and Gulf of Mexico coasts are at historically low levels. About 75 percent of the nation's commercial fisheries of fish and shellfish are estuarine-dependent. These species rely on estuaries and the upper reaches of tidal rivers for early life stages, food, or

Trends in fishery stocks in U.S. waters.

Biomass of north central Gulf of Mexico bottomfish.



Yield of Caribbean reef fish.



Note: North central Gulf of Mexico bottomfish include Atlantic croakers; spot, sand, and silver seatrout; and other groundfish that often are part of shrimp fishing bycatch. Caribbean reef fish include snappers, groupers, and other fishes that prefer coral reefs, artificial structures, or other hardbottom areas.
Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, *Our Living Oceans,* NOAA Tech. Memo. NMFS-F/SPO-1, (Washington, DC: DOC, 1991).

migrations and thus can be vulnerable to habitat degradation in some watersheds that are far from the sea. Recent declines in fish and shellfish are attributable to a combination of overharvesting, bycatch waste, habitat degradation, and introduction of foreign species.

Overharvesting

Of the 232 groups of fish (including 450 species) for which NMFS is responsible, at least 28 percent are overharvested, 25 percent can sustain the current utilization rate, and 13 percent could sustain increased utilization. So little information is available for another 34 percent that the agency can not assess their status. The continued expansion of domestic fishing capacity has contributed to depletion of more than 100 U.S. fishery stocks and to increasing conflicts among the needs of commercial and recreational fisheries, Native American fisheries, and marine mammals.

Bycatch Waste

Another problem arises when fish, seabirds, dolphins and other marine mammals, sharks, and turtles are inadvertently caught by fishermen in pursuit of more marketable sizes and species. Billions of pounds of fish are wasted as bycatch each year. The shrimp industry alone discards about nine pounds of young fish for every pound of shrimp harvested. Among the discarded fish are a number that would have high commercial values at maturity. The incidental take of marine mammals is documented by studies that show 40 walruses per year being taken by groundfish trawls in Alaska, 66 northern sea otters captured by drift gill netters, and 14 manatee mortalities associated with commercial fishing.

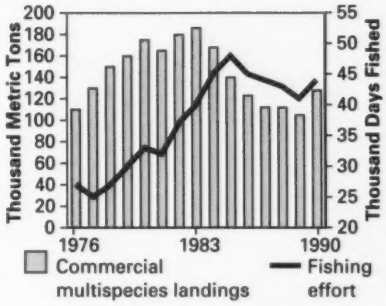
Habitat Degradation

Development, water diversions, pollution, and nutrient over-enrichment degrade river systems and coastal habitats for anadromous and marine species.

The most essential and most imperiled habitat types are coastal estuaries or bays, tributary rivers, and wetlands ecosystems. Estuaries are among the most highly productive biological systems on earth, and many species of fish depend on them for survival. At least 75 percent of the fish and shellfish commercially harvested in the ocean are estuary-dependent, but in the Gulf of Mexico, the figure may be as high as 98 percent.

Water projects, including federally licensed hydropower projects, have contributed to the decline in the nation's fish species, especially anadromous species that live most of their adult lives at sea but return upriver to reproduce where they were spawned. Dams and

Trawl catch and effort off the northeastern United States.



Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, *Our Living Oceans*, NOAA Tech. Memo. NMFS-F/SPO-1, (Washington, DC: DOC, 1991).

Trends in Living Marine Resources

The following are examples of recent declines in living marine resources:

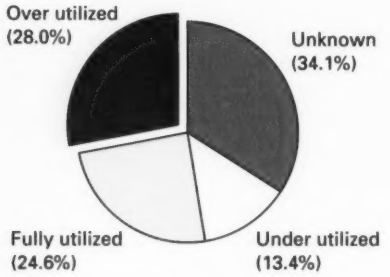
- **Chesapeake Bay.** Over the past three decades, catches of migratory fish species in the Chesapeake Bay declined 82 percent; and the Maryland oyster harvest declined more than 90 percent from levels of a century ago. Up until a decade ago, oyster declines were attributable primarily to overharvesting, but since 1980, oyster diseases have ravaged the stocks.

- **Southeast Atlantic/Gulf of Mexico.** Commercial landings of inedible and edible fish and shellfish along the southeast Atlantic and Gulf of Mexico coasts are down 31 percent since 1987.

- **Columbia River.** Columbia River Basin salmon and steelhead have declined by 84 percent from estimated historic levels of 10 million to 16 million fish per year. The nation has lost half of the original 400 individual races of these salmon, and among the survivors are a number of candidates for the Endangered Species list. The Snake River sockeye salmon was listed as endangered in 1991.

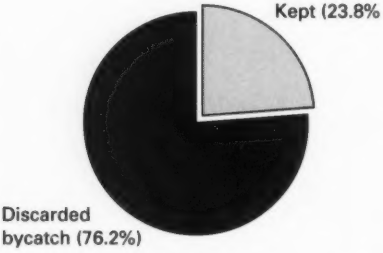
- **California.** Populations of winter-run chinook salmon, a threatened species, are down from 86,500 spawners in 1969 to 300 in 1991; and adult populations of striped bass in San Francisco Bay have declined by 80 percent.

Status of fishery stocks in U.S. waters.



Note: Based on a total of 232 stocks assessed in 1990.
Source: See Part II, Table 78.

Trawl bycatch of yellowtail flounder.



Note: Based on 558,233 kilograms of multispecies catch from 342 hauls on 25 fishing trips in 1990.
Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, *Our Living Oceans*, NOAA Tech. Memo. NMFS-F/SPO-1, (Washington, DC: DOC, 1991).

other structures in rivers may impede the passage of adult fish moving upstream to spawn and young fish moving down to the sea. On the Columbia River and its tributaries, more than three dozen dams have blocked fish migrations. In the Northeast, even with extensive restoration projects on rivers, only 47 percent of former Atlantic salmon habitat is accessible to returning salmon.

Introduction of Foreign Species

A long-standing concern with regard to terrestrial plant and animal communities, the introduction of foreign species also can diminish the biodiversity of marine communities by adding new pressures of population and competition.

Policies and Programs

In 1991 the federal government funded a number of programs designed to improve fish habitat and to facilitate the passage of anadromous fish to and from the sea. To improve marine fisheries, the National Marine Fisheries Service worked through eight regional Fishery Management Councils, in cooperation with coastal and Great Lakes states and with U.S. territories. An annual report, *Fisheries of the United States*, contains current information on the program. The Fish and Wildlife Service is a non-voting member of each council, and the Coast Guard participates by advising on enforceability of proposed regulations.

Magnuson Fishery Conservation and Management Act

The Magnuson Act and its 1990 amendments authorize the Secretary of Commerce to conserve and manage U.S. marine fishery resources and, with the Secretary of State, to negotiate international cooperation to manage such migratory species as tunas, swordfish, billfishes, whales, and oceanic sharks. Enforcement responsibilities are shared by the Secretary of Commerce and the Secretary of the department in which the Coast Guard is operating (Department of Transportation during peacetime and Department of Defense in time of war).

Driftnet Fishing Ban

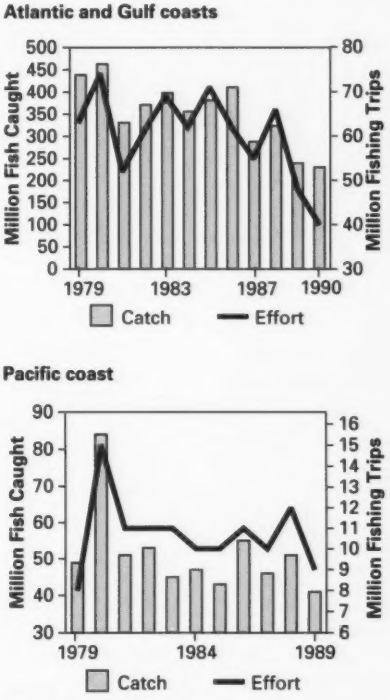
The Magnuson Fishery Conservation and Management Act Amendments of 1990 authorized negotiations on international agreements to implement a ban on large-scale driftnet fishing. U.S. officials may monitor compliance with the ban by placing observers on board vessels of signatory countries and by inspecting such vessels. The National Marine Fisheries Service and the U.S. Coast Guard enforce the driftnet ban, which protects U.S. salmon, among other species.

In accordance with the 1990 Magnuson Act Amendments, NMFS has approved 32 Fishery Management Plans (FMPs) prepared by regional Fishery Management Councils and numerous plan amendments to conserve and manage more than 540 species of finfish, shellfish, corals, and sponges. The agency is defining overfishing within each FMP and has completed 16 such definitions, with the remainder being readied for approval. In 1990 more than 500 regulatory notices for fisheries under FMPs were published in the *Federal Register*, dealing with such measures as quotas and allowable catches, area and seasonal closures, gear restrictions, prohibited species catch limits, and proposed rules.

Protected Species

The National Marine Fisheries Service and the Fish and Wildlife Service manage marine mammals under the Marine Mammal Protection Act (MMPA), and some species receive further protection under the Endangered Species Act (ESA). The Coast Guard provides at-sea enforcement of these acts. The Magnuson Act also addresses the management of marine mammals, as does the Whale Conservation Act of 1976, which aids the recovery of whales. Of the 37 marine mammal species found off the Atlantic and Gulf of Mexico coasts, 7 are listed as endangered under the ESA; of the 45 species in Pacific U.S. waters, 12 are endangered or threatened. Sea turtles, some sturgeon, and some Pacific salmonids also are protected. Coast Guard enforcement operations include domestic and foreign fisheries regulations,

Marine recreational fishing.



Source: See Part II, Table 83.

Turtle Excluder Device (TED) rules, and Marine Mammal Protection Act regulations in Bering Sea rookeries and within the Hawaiian Islands. The National Marine Fisheries Service and the Fish and Wildlife Service develop and implement recovery plans for listed species, including assessment of population sizes and condition.

Fish and Wildlife Coordination Act

This 1958 law directs that the conservation of U.S. fish and wildlife resources be given equal consideration with other aspects of water resource development projects. The Act requires evaluation of potential damage to fish and wildlife that may result from proposed habitat alteration, such as dredging of navigable waters. It mandates mitigation or prevention of such loss and encourages improvement of both fish and wildlife resources. It also requires federal agencies to consult with NMFS on proposals that could affect water essential to living marine resources. As a result, NMFS participates in federal decisionmaking on some 10,000 projects per year and about 30,000 consultations with other agencies and the public.

NMFS Strategic Plan

In 1991 NMFS developed a 5-year strategic plan to address such concerns as federal monitoring programs and adequate fisheries data. Insufficient data can result in regulations that are inadequate to conserve resources or that are unnecessarily restrictive. Other public concerns involve open access to fisheries, nonselectivity of fishing methods, and the safety and wholesomeness of seafood products.

Status of Living Marine Resources

NMFS organized a national stock assessment workshop in 1991 to evaluate methodologies and prepare the publication, *Our Living Oceans: The First Annual Report on the Status of U.S. Living Marine Resources.*

NOAA Science Programs

NOAA science programs, such as the Coastal Ocean Program (COP) and the Climate and Global Change Program (CGC) are developing a fisheries forecasting capability. Cooperative studies involve three COP components—Coastal Fisheries Ecosystems, Estuarine Habitats, and Toxic Contaminants—and the CGC Marine Ecosystem Response Project to provide information on oceanic and atmospheric processes affecting short-term and long-range variability of living marine resources. Under these programs, NMFS scientists team with other NOAA offices, government agencies, universities, and the private sector to coordinate research.

Damage Assessment and Restoration

NOAA established a Damage Assessment and Restoration Program in 1991 to determine and quantify injury to living marine resources. NOAA agencies, such as NMFS and the National Ocean Service, are joining forces to secure monetary damages from responsible parties and to use recovered damages to restore injured resources and habitats. Scientists are working through a new Habitat Restoration Center, established at NMFS headquarters in 1991, to restore living marine resource habitat damaged primarily by oil and other hazardous materials spills.

Forestry

Enhance the quality of renewable resources...
National Environmental Policy Act, section 101(b)(6)

Also see Biodiversity, International Issues, Public Lands, and related tables and figures in Part II.

Forestry is the science and art of getting the most of what people want from the forest—be it water, wildlife, wood, or wilderness. With passage of the Multiple Use-Sustained Yield Act of 1960, the federal government recognized that forests are more than trees. Forest ecosystems are vital to the health and welfare of the nation for such uses as recreation, watersheds, wilderness, and wildlife habitat, as well as for such commodity uses as timber, minerals, and range. Globally forests play a central role in the cycle of atmospheric gases and serve as a primary source of valuable products, such as food, fiber, and raw materials for pharmaceuticals.

Conditions and Trends

The trend in forestry is toward managing forests as complex ecosystems made up of interdependent communities of plants, animals, and microbes, rather than managing them for single outputs such as timber or game species. The transnational nature of current natural resources issues, such as deforestation, forest dieback, acid deposition, and climate change, has led to a new emphasis on international forestry.

U.S. Forestland

U.S. forest types vary from scrub forests of the arid interior West to highly productive forests of the Pacific Coast and the South. In 1987 forests occupied about one-third (731 million acres) of the total U.S. land area, with 525 million acres of this forestland owned by nonfederal public agencies, the forest industry, farmers and ranchers, and other private individuals. Nonfederal forestlands are concentrated in the eastern United States, and forest ownership in the West is evenly divided between the federal government and other public and private owners.

In recent decades, the area of U.S. forestlands has been declining. In the late 1970s and early 1980s, many acres

Global Forest Convention

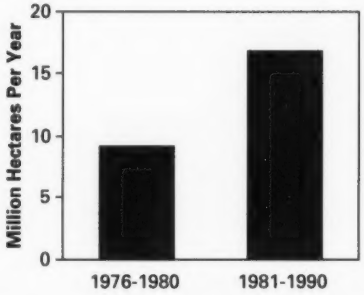
Around the world and especially in developing nations in the Tropics, forests are being destroyed at an accelerating rate. At the 1990 Economic Summit in Houston, President Bush proposed that negotiations begin as soon as possible on a global forest convention to curb deforestation, protect biodiversity, improve forest management, and address threats to the world's forests. The 1991 Economic Summit in London reiterated the need for a forest convention and set the goal of achieving agreement on forest principles by the time of the United Nations Conference on Environment and Development (UNCED) scheduled for June 1992 in Brazil.

The United States advocates a forest convention emphasizing the following elements:

- Market-based conservation mechanisms,
- Forest health,
- Reforestation, and
- Forest products.

A statement of principles is being negotiated through the UNCED preparatory process and should serve as the basis for subsequent negotiations on a forest convention.

Annual rate of tropical deforestation.



Note: The 1980 FAO/UNEP Tropical Forest Resources Assessment Project estimates the total forest area of the Tropics at 1.95 billion hectares. The 52 countries common to the 1980 and 1990 assessments possessed 78 percent of this area. During the 1981-1990, the area of deforestation was 16.8 million hectares annually.
Source: The United Nations Food and Agriculture Organization and the United Nations Environment Program, 1990.

were converted to agricultural crop production, in part because of a rapid growth in agricultural exports. Pressures to convert forests for urban and other developed uses are substantial and likely will increase along with projected changes in population, personal income, and other related factors. At projected rates, the total area of forestland could decline by 4 percent by the year 2040 to 703 million acres, with an annual decline of half a million acres. This rate of decline would be slower than the rate between 1970 and 1987, when total forestland area declined by 1.5 million acres each year.

Forest Regeneration

Artificial regeneration is an increasingly important component of forest management. During fiscal 1990 public and private forest owners regen-

erated 2.86 million acres by tree planting and artificial seeding, and a comparable area of forestland regenerated naturally. Approximately 83 percent of the tree plantings occurred on private lands, with the forest industry providing 41.5 percent of the total. Nonindustrial owners also planted more trees, as did urban areas.

Biodiversity

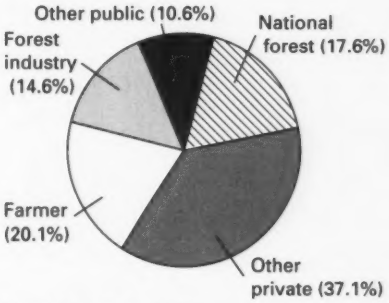
Since first settled by Europeans, the area that is now the United States has seen a decline in natural systems as the result of land clearing for agriculture, industry, and urban development. In recent years, the nation has experienced a renewed interest in maintaining natural systems for their biodiversity and in restoring them when possible. Championed by conservation groups and some public agencies, the movement to manage lands for biodiversity is attracting a number of corporate advocates as well.

Forest Health

Most U.S. forests—federal, state, and private—are healthy and productive. Short-term regional health problems arise in response to cyclical population increases of native pests and tree stress generated by climactic variations such as drought. Individual unhealthy and declining trees in old-growth forests are essential parts of these ecosystems that support diverse biota. Forest health problems are associated with ecosystems that have been greatly disturbed or modified by human activities or by introduced forest pests.

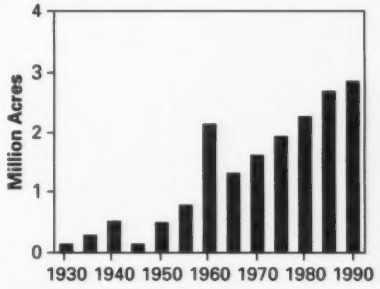
For example, on the eastern slopes of the Cascades and Blue Mountains in the Pacific Northwest, single-tree selection, fire exclusion, and lack of thinning have resulted in stands ill-adapted to their sites, prone to insect and disease problems, and stressed by overstocking and frequent periodic droughts. In the Intermountain West, selection harvesting of western white pines and blister rust have resulted in a new forest of shade-tolerant trees prone to root disease and insects. In the Pacific Southwest, air pollution has reduced the health of the forests, and across the nation, forest pests have adversely affected forest health and productivity.

Timberland in the United States by ownership.



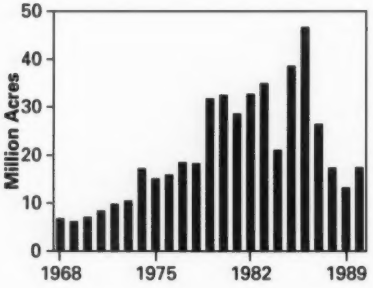
Note: Data is for 1987.
Source: See Part II, Table 57.

Reforestation in the United States.



Source: See Part II, Table 61.

U.S. forest insect damage.



Note: Data include eastern spruce budworm, western spruce budworm, gypsy moth, mountain pine beetle, and southern pine beetle. Southern pine beetle data were not available in 1984.
Source: See Part II, Table 62.

Policies and Programs

The past year saw a number of new forestry initiatives, from planting trees to make America more beautiful to international forestry projects in Eastern Europe and the Tropics.

America the Beautiful

To meet President Bush's goal to plant a billion trees per year in this decade, the USDA Forest Service is working with state foresters to support annual planting of 970 million trees in rural areas and 30 million trees in urban areas. In 1991, the first year of the initiative, over 25 million trees were planted or improved in urban areas. To support the rural element of this initiative, the USDA Forest Service and state foresters seek to enlist millions of acres of nonindustrial private land into forest management through a cost-sharing Stewardship Incentive Program. Funding was $19.8 million in 1991, and signups are scheduled in 1992 for cost-share projects such as the following:

- Stabilizing eroded lands,
- Protecting riparian areas and wetlands,
- Improving fisheries habitat,
- Enhancing forest recreation, and
- Establishing and renovating windbreaks and hedgerows.

State foresters are working with the Forest Service, Soil Conservation Service, Extension Service, and Agricultural Stabilization and Conservation Service to provide the technical assistance needed for the program.

Through a Forest Stewardship Program, the USDA Forest Service cooperates with state foresters and private nonindustrial landowners to develop forest stewardship plans prior to timber harvests. In 1990 the program assisted landowners with 8,700 forest stewardship plans on 840,000 acres of private forestland. In 1991 an additional 12,000 plans improved management of 1.4 million acres for a total of 2.2 million acres in the program to date. Program funding was $5.9 million for 1990 and $12 million for 1991. All 50 states have formed State Forest Stewardship Coordinating Committees to assist state foresters with the program.

National Tree Trust

The National Tree Trust, a nonprofit private foundation, was created by the 1990 Farm Bill to raise private-sector funds to help foster the national reforestation effort. In 1991 the National Tree Trust began operations in Washington, DC.

National Forests

The National Forest System, with 191 million acres in 156 national forests, contains 30 percent of the nation's total volume of growing stock and nearly half of the softwood sawtimber volume. Recently national forests

Old-Growth Forests and the Northern Spotted Owl

One of the most contentious environmental issues of 1991 concerned old-growth forests in the Pacific Northwest. Actions to protect these diverse ecosystems by reducing federal timber harvests have raised concern over economic impacts on small, timber-dependent communities.

Listing of the northern spotted owl as threatened under the Endangered Species Act in July 1990 increased the pace of activity for this longstanding issue. For example, an interagency team composed of federal, state, and university representatives met in February 1991 to develop a plan for eventual recovery of the species. In September 1991 the USDA Forest Service issued a Draft Environmental Impact Statement on management of spotted owl habitat on national forests. In January 1992 the DOI/Fish and Wildlife Service adopted regulations designating 6.9 million acres in Oregon, Washington, and California as "critical habitat" for the owl.

Responding to a petition from the DOI/Bureau of Land Management, the Secretary of the Interior agreed in October 1991 to convene the Endangered Species Committee to consider 44 timber sales in Oregon that the Fish and Wildlife Service determined would jeopardize the existence of the owl. Under provisions of the Endangered Species Act, the committee may allow such sales to proceed if it determines the following:

- No reasonable and prudent alternatives exist;
- The benefits of the action "clearly outweigh" the benefits of alternatives that would preserve the species;
- The action is of regional or national significance;
- Neither the federal agency involved nor the exemption applicant has committed resources that would preclude adopting alternatives, and
- Appropriate mitigation measures are identified.

The committee includes the secretaries of the Interior, Army, and Agriculture, the administrators of the National Oceanic and Atmospheric Administration and Environmental Protection Agency, the chairman of the Council of Economic Advisors, and a representative from the affected state (in this case, Oregon). A hearing record is being developed for presentation to the committee, and a decision is expected in early 1992.

U.S. Forest Service

Forest ecosystems provide recreation opportunities, watersheds, wilderness, wildlife habitat, and timber and other commodities.

have provided about 13 percent of the total annual wood harvest in the United States and one quarter of the softwood timber used for lumber and plywood. They also provide wood and wood products not readily available from nearby state or private lands. In the eastern United States, national forests are the source of quality hardwoods suitable for furniture and interior construction, and in the South, they provide construction-grade softwood lumber as well as hardwood species. In 1990 national forests produced 10.5 billion

board feet of timber with a value of $1.4 billion. In the same year, the Forest Service reforested 500,000 acres with over 50 different tree species.

Department of the Interior Forestlands

Within the Department of the Interior, the Bureau of Land Management manages 48 million acres of forestlands; the Fish and Wildlife Service and the Bureau of Indian Affairs each manage 16 million acres of forestlands, and the National Park Service manages forestlands as part of the National Park System. In 1990, as part of a reforestation program, BIA planted 4 million trees, and BLM planted 13 million. In 1991 BLM estimates having planted 17 million trees.

Department of Defense Forestlands

DOD manages 6 million acres of forestland, of which 2.3 million acres on 150 military installations support commercial forest management. The DOD forestry program runs a small profit each year, with 1989 receipts of $12.7 million. In 1991 DOD and EPA signed an agreement on forest and land management, pollution prevention, and climate change. Under the agreement, EPA has evaluated forestry and land management practices on a number of DOD installations and is preparing a joint publication, "The Feasibility of Enhancing the Management of Forests and Vegetation on DOD Lands." The two agencies are also developing a project to enhance and measure energy conservation on military installations through strategically planted trees.

Timber Sale Program Information Reporting System

Across the nation, many communities depend on the harvest and processing of national forest timber as part of their local economies. Through the Timber Sale Program Information Reporting System (TSPIRS), the USDA Forest Service provides annual reports on the results of national forest harvests. In 1990 timber harvests on national forests provided 106,000 jobs and $3.2 billion of income from wood and wood products.

Forest Pest Suppression

In December 1990 the Department of Defense and the Department of Agriculture signed an agreement to address the problem of forest insects and diseases. Under the agreement, the USDA Forest Service is funding forest pest suppression on military lands. A USDA-DOD review board selects priority projects. In 1991 the Forest Service transferred $1.1 million to fund gypsy moth suppression on 44,000 acres at nine military installations. An additional $50,000 was spent on gypsy moth suppression on 2,000 acres in two Corps of Engineers districts.

International Forestry

The 1990 Farm Bill authorized the USDA Forest Service to increase support for international forestry. The Forest Service is providing program support to the Department of State and other agencies involved in global natural resource issues, such as proposed conventions on forestry, biodiversity, and climate change. The International Forestry Cooperation Act, included in the Foreign Operations Appropriations Act of 1990, authorized the Secretary of Agriculture to increase support for international forestry. Efforts include providing technical assistance, sharing natural resources skills, broadening education and training opportunities, engaging in scientific exchange and

cooperative research, and cooperating with domestic and international organizations. The Forest Service is concentrating efforts in countries where programs can have a substantial impact on net greenhouse gas emissions and in countries where the U.S. Agency for International Development (AID) has programs. AID forestry programs are underway in numerous developing nations, many of them in the Tropics. In 1991, recognizing the increasingly global nature of forest issues, the Forest Service elevated the International Forestry Staff to division status.

Hazardous and Solid Wastes

Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences...

National Environmental Policy Act, section 101(b)(3)

See also Federal Facilities Management, Pollution Prevention, Technology, and related tables and figures in Part II.

In recent years, disposal problems have changed the way the nation thinks about waste. Improperly handled, hazardous and solid wastes can contaminate drinking water supplies, release toxic vapors into the air, or cause explosions. Meanwhile, the number of landfills open to receive wastes is falling, and new facilities are difficult to site. In October 1991 the President signed an Executive Order on waste reduction and recycling. While the order applies only to federal agencies, specifying that each agency shall develop an affirmative waste reduction and recycling strategy, the message to the nation as a whole is clear: the time has come to reduce wastes.

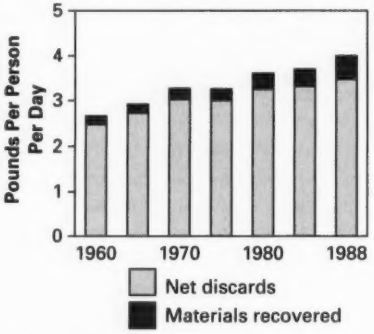
Conditions and Trends

Until the 1970s federal agencies had little authority to regulate hazardous and solid wastes. Disposal often took place in an unsafe manner at landfills or in unlined lagoons, with some wastes simply dumped on the ground or in surface waters. In 1976 Congress passed the Resource Conservation and Recovery Act (RCRA), which led to cradle-to-grave regulation of hazardous and other categories of solid wastes, including municipal solid wastes. RCRA, with provisions for state regulation, has been joined by other laws that authorize the Environmental Protection Agency (EPA) and the states to undertake programs to accomplish the following objectives:

- Prevent pollution,
- Manage hazardous wastes,
- Clean up hazardous waste sites,
- Ensure the safety of underground storage tanks containing petroleum or hazardous substances, and
- Address the growing volume of municipal solid waste.

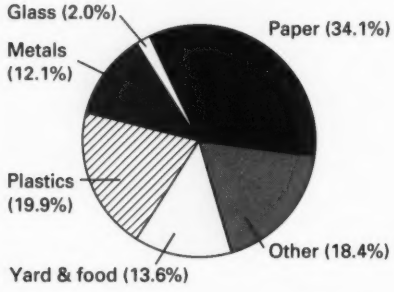
Americans produced an estimated 88 million tons of trash in 1960; in 1988 that volume had risen to 180 million tons—roughly 4.5 pounds per person per day. If that trend were to continue, Americans might well be generating 216 million tons of trash annually by the year 2000. Meanwhile the number

Municipal solid waste disposal and recovery, per capita.



Source: See Part II, Table 86.

Material discards in the 1988 municipal waste stream, by volume.



Note: Total volume= 400 million cubic yards. Total weight= 179.6 million tons.
Source: See Part II, Table 87; U.S. Environmental Protection Agency; Office of Solid Waste and Emergency Response, *Characterization of Municipal Solid Waste in the United States,* (Washington, DC: EPA, 1990).

of landfills open to receive these wastes declined from approximately 20,000 in 1978 to fewer than 6,000 in 1991, and many of these may be full by the mid-1990s. New waste management facilities are often difficult to site because of a number of factors including public opposition.

The national trend is to reduce the amount and toxicity of wastes through such approaches as pollution prevention and recycling. The rate at which materials in the municipal solid waste stream were diverted to recycling or composting rose from 7 percent in 1960 (6 million tons) to 13 percent (23 million tons) in 1988. In the late 1980s, the recycling rate continued to increase rapidly.

Regulating exports of hazardous and other wastes is another emerging trend. On March 22, 1990, the United States signed the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Proposed federal legislation to implement the Basel Convention would prohibit the export and import of wastes unless the United States has a bilateral agreement with the other country ensuring that wastes will be handled in an environmentally sound manner.

Policies and Programs

As the volume of hazardous and solid wastes increased along with national growth, federal, state, and local governments have responded with a number of programs.

Hazardous Waste

The storage, transport, and disposal of hazardous wastes are regulated in the United States by a number of environmental laws.

Resource Conservation and Recovery Act. RCRA regulates the handling, transportation, storage, and final disposal of solid wastes generated by more than 200,000 generators. Many wastes are now banned from land disposal if not treated to meet EPA standards, which require use of the best available treatment technology (chemical or biological treatment or incinera-

tion) to reduce toxicity and stabilize residues. In 1987 the last year for which data are available, 233 million tons of hazardous waste were being treated prior to landfill disposal.

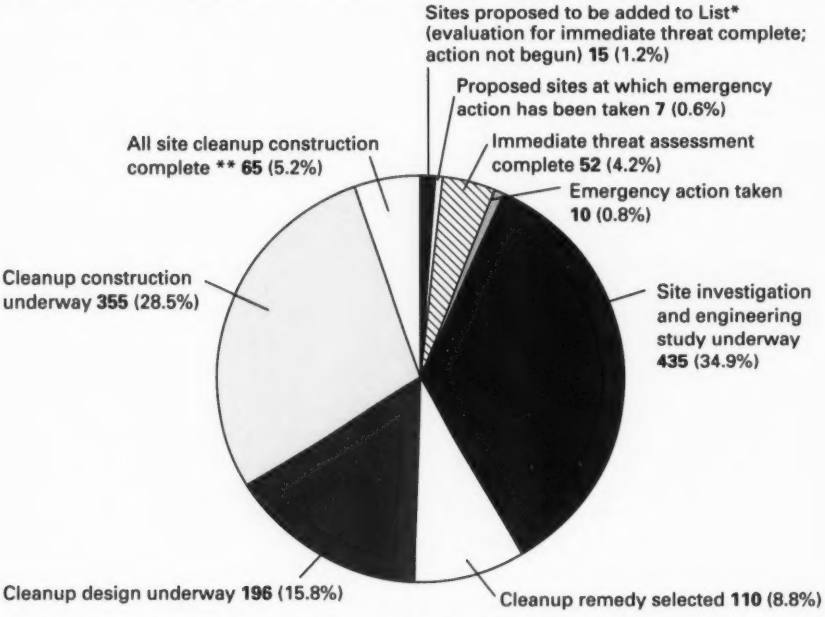
Superfund. The 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) created a program to identify and clean up releases of hazardous substances stemming from accidents or uncontrolled hazardous waste sites. The law requires that those responsible for contamination must conduct the cleanup. Where enforcement is not successful, EPA can clean up a site using the CERCLA trust fund, largely funded by excise taxes on feedstock chemicals and petroleum. If EPA conducts the cleanup, the government can take court action against responsible parties to recover treble damages. In fiscal 1991 parties responsible for contamination at nonfederal Superfund sites agreed to perform 60 percent of new cleanup work. The total value of responsible party commitments has exceeded $1 billion for each of the past three years, and since 1989, the rate of cleanups has tripled.

Cleanups. To date, EPA has identified 34,000 potentially hazardous waste sites across the nation and has conducted preliminary assessments on more than 90 percent of these. Half of the sites require no further federal action, as they will be handled by states and private parties. The agency lists the most serious sites on the Superfund National Priorities List (NPL), which currently consists of 1,207 sites. NPL listing makes these sites eligible for Superfund cleanups. To date, Superfund has treated, isolated, neutralized, or removed from the environment 13 million cubic yards of contaminated soil and solid wastes, a billion gallons of liquid waste, 6 billion gallons of contaminated groundwater, and 316 million gallons of polluted surface water. EPA targets call for 130 NPL sites to be cleaned up by the end of 1992, 200 by the end of 1993, and 650 by the end of the year 2000. The expenditures associated with Superfund are forecast by EPA to increase from $2 billion per year (in annualized 1986 dollars) to over $8 billion per year in 2000.

Emergency response. Superfund authorizes EPA and the U.S. Coast Guard to respond to threats that pose immediate health and environmental hazards. These range from acute, life-threatening hazardous substance explosions and spills (from transportation accidents, for example) to improper management of hazardous waste, such as at NPL sites. EPA responds to emergencies that occur inland or in inland waters, and the Coast Guard has jurisdiction over accidental releases in or near coastal waters and the Great Lakes. Both agencies maintain nationwide networks of emergency response teams and experts on call 24 hours a day, 365 days a year. To date, EPA emergency response personnel have taken action in more than 1,400 such situations and supervised responsible party cleanup in more than 600 other cases. The Coast Guard has taken action in more than 2,000 cases. There were a total of 346 Superfund emergency response actions in fiscal 1991.

Underground Storage Tanks. Chemicals that escape from underground tanks containing petroleum or other chemicals (for example, beneath gas stations and other operations) can contaminate drinking water supplies, and fumes can cause health and safety hazards. The 1984 RCRA Amendments require tank registration, leak detection, and leak prevention. Affected states

Figure 14-3.—Superfund remediation at National Priority List sites.


Sites proposed to be added to List* (evaluation for immediate threat complete; action not begun) 15 (1.2%)
Proposed sites at which emergency action has been taken 7 (0.6%)
Immediate threat assessment complete 52 (4.2%)
Emergency action taken 10 (0.8%)
Site investigation and engineering study underway 435 (34.9%)
Cleanup remedy selected 110 (8.8%)
Cleanup design underway 196 (15.8%)
Cleanup construction underway 355 (28.5%)
All site cleanup construction complete ** 65 (5.2%)

* The Environmental Protection Agency (EPA), which administers Superfund, has asked for comments on its plans to add these sites to the National Priorities List (NPL), making them eligible for permanent Superfund cleanup.

** As of February 10, 1992, all cleanup construction had been completed at 70 sites.

Note: Segments are cumulative; for example, sites with construction underway have already completed study, remedy selection, and design. As of December 31, 1991, of the 1,205 NPL sites or proposed sites or the 40 sites deleted from the List, 119 were located at federal facilities. The cleanup of these sites is the primary responsibility of the departments and agencies that operate them; by law, Superfund cannot pay for their permanent cleanup.
Source: U.S. Environmental Protection Agency, 1992.

can use the Leaking Underground Storage Tank Trust Fund, which has collected over $700 million for cleanup actions as of October 1, 1991.

Municipal Solid Waste

The nation can address local solid waste disposal problems by reducing the amount and toxicity of waste generated or by reducing the amount of waste needing disposal by such techniques as source reduction, recycling, and composting where feasible. While the federal government has established standards aimed at protecting human health and the environment, implementation of solid waste programs remains largely a state and local matter.

Landfills. In September 1991, EPA issued regulations to improve the safety of municipal landfills. New management standards for municipal landfills cover six categories of concern: location restrictions, operating requirements, design standards, groundwater monitoring and corrective action, closure and post-closure care, and owner financial responsibility. Regulations

cover facilities throughout their operating life and for 30 years after closure. The rule is also an incentive for increasing source reduction and recycling nationwide.

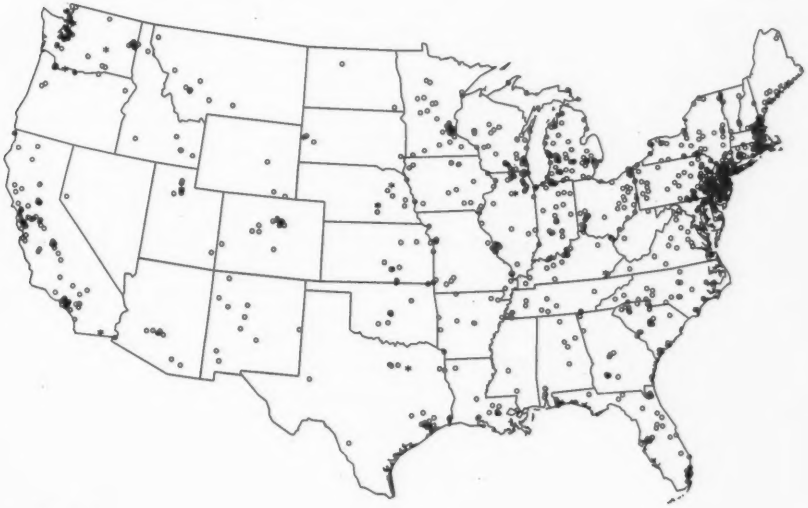
Recycling. In October 1991 President Bush signed Executive Order 12780, the Federal Recycling and Procurement Policy, which requires that federal agencies increase recycling efforts and encourage the market demand for recycled products by favoring the use of recycled materials. To develop guidelines for recycling and the purchase of recycled goods, each agency will designate an agency recycling coordinator. The order creates a federal recycling coordinator and a Council on Federal Recycling and Procurement Policy to oversee agency recycling actions.

EPA administers a recycling program that assists state and local govern-

Hazardous Waste Emergency Hotline

To report emergencies that pose immediate health and environmental hazards, the public may call the National Response Center for Oil and Hazardous Materials Spills. The toll-free phone number is 1-800-424-8802. In the Washington, D.C., area, the phone number is 202-426-2675.

National Priority List sites.



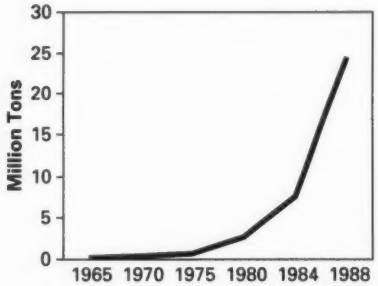
o = Final site
* = Proposed site

Not shown: Alaska, 6; Guam, 1; Hawaii, 2; and Puerto Rico, 9; as of September 10, 1991.

National totals: Final NPL sites 1,185; Proposed NPL sites 22; Total NPL sites 1,207

Source: U.S. Environmental Protection Agency, 1991.

Municipal solid waste combusted for energy.



Source: U.S. Environmental Production Agency; Office of Solid Waste and Emergency Response, *Characterization of Municipal Solid Waste in the United States,* (Washington, DC: EPA, 1990).

ments with projects such as the following:

- Publication of guides on composting and on recycling materials from motor oil to office paper;
- Creation of a solid waste information clearinghouse;
- Market assessments for recyclable materials, such as *Markets for Scrap Tires*, issued in December 1991 as the first in a series; and
- Publication of educational materials, such as *Recycle Today!*, a 4-part set.

Rate-pricing. Some local and municipal governments are charging disposal fees which vary by the weight or volume of wastes that households generate. Waste disposal fees in many areas of the nation are beginning to reflect direct and indirect costs. Full-cost and variable rate pricing can spur cost-effective waste minimization and recycling by sending market signals to households.

Waste to Energy. Currently 132 municipal waste-to-energy plants are in operation, converting about 11 percent of the nation's waste into energy. Combustion products, otherwise known as residue or ash, may be high in concentrations of heavy metals that, if improperly handled, can leach into the environment with adverse impacts. With proper planning and management, this problem can be overcome. The National Energy Strategy projects that waste-to-energy plants in the year 2010 will produce seven times the amount of power currently generated from such sources.

Innovative Technologies

The EPA Technology Innovation Office, created in March 1990, promotes the development and use of new treatments for cleanup problems such as decontaminating soils and groundwater far beneath the surface. The EPA Superfund Innovative Technology Evaluation Program measures the effectiveness of new techniques for destroying, immobilizing, or reducing hazardous waste and contaminated materials.

By September 1991 EPA had conducted 21 pilot and full-scale field demonstrations of new technologies prior to commercialization, and 74 technologies are set for future demonstrations. These include soil washing, chemical dechlorination, underground vacuum extraction, and forcing of airstreams through water to evaporate volatile organic compounds. EPA is evaluating bioremediation—the use of microbes to break down organic contaminants—at demonstration cleanups across the country. As of July 1991, the agency had selected new technologies for 140 remedial actions at NPL sites. This figure comprises 40 percent of all technologies selected.

International Issues

Recognize the worldwide and long-range character of foreign environmental problems and. . . lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment. . .

National Environmental Policy Act, section 102(F)

See also Forestry, Mission to Planet Earth, and related tables and figures in Part II.

In recent years, environmental challenges have been a priority on the agenda for international cooperation. International environmental concerns include such diverse but interrelated issues as climate change, stratospheric ozone depletion, food security, health of the oceans, water supply, population change, conservation of biological diversity and natural resources, and pollution prevention and control. Recognizing that many of these problems cross political boundaries, contribute to socio-political unrest, and are best addressed in a context of sustainable economic growth and political openness, the United States is helping to define a common global agenda and shared responsibilities for environmental stewardship.

Conditions and Trends

A wealth of literature on worldwide environmental conditions is available from such official sources as the Organization for Economic Cooperation and Development (OECD), the United Nations Environment Programme, the World Bank, and private sources including the World Resources Institute and the Worldwide Fund for Nature. Although a comprehensive summary of international environmental conditions is beyond the scope of this report, several trends are of particular public concern.

Ozone Layer

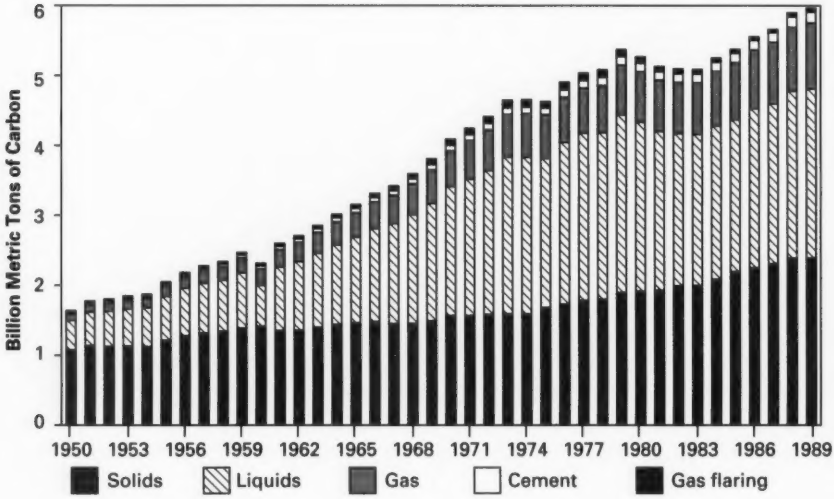
In the upper atmosphere, chlorine concentrations resulting from human activity have increased to a level that is damaging the ozone layer, which protects Earth from harmful doses of the sun's ultraviolet radiation. Recently published scientific evidence suggests that ozone depletion over the last decade is more than twice what previous studies projected. Thinning of the ozone layer has been detected over the polar regions and in the northern mid-latitudes. While evidence is currently unavailable to suggest that ground-level ultraviolet radiation is escalating, increased exposure could lead to greater

incidence of skin cancer, cataracts, and ecological damage.

Global Climate Change

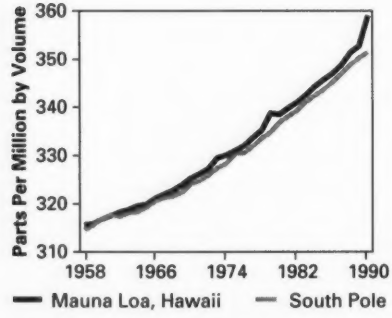
Certain atmospheric gases—including carbon dioxide, methane, nitrous oxide, and others—trap solar rays that would otherwise be radiated back into space. Without this basic heat-trapping phenomenon known as the "greenhouse effect," Earth would be uninhabitably cold. The First Assessment report by the Intergovernmental Panel on Climate Change and subsequent analyses indicate substantial evidence that man-made greenhouse gas emissions will result in enhanced warming of the Earth. If such predicted warming were actually to

Global emissions of carbon dioxide from human activities.



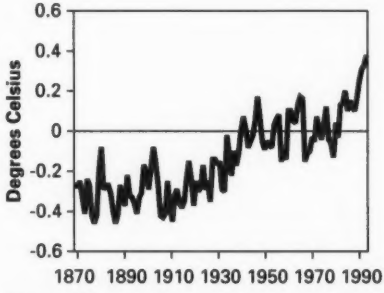
Source: See Part II, Table 42.

Atmospheric concentrations of carbon dioxide.



Source: See Part II, Table 43.

Global surface temperature variations.



Note: Global surface temperature is relative to a 1950-1979 reference period mean.
Source: See Part II, Table 41.

United Nations Conference on Environment and Development (UNCED)

To celebrate the twentieth anniversary of the landmark Stockholm Conference on the Human Environment, the United Nations is sponsoring the U.N. Conference on Environment and Development to be held June 1-12, 1992, in Rio de Janeiro, Brazil. Promising to be the largest event of its kind in history, UNCED will shape international environment and economic development agendas into the next century. Throughout 1991 the United States worked on the UNCED Preparatory Committee and on negotiations for agreements, including the following:

- **Climate change.** To address concerns that human activities may lead to adverse changes in global climate patterns, nations are developing a global framework convention on climate change.
- **Biological diversity.** Facing worldwide declines in habitat and species diversity, nations are working on a global framework convention to conserve biodiversity.
- **Forestry.** In 1990 President Bush proposed the negotiation of a global framework convention on management, conservation, and research of the world's forests.
- **Agenda 21.** This product of UNCED will be a comprehensive agenda of actions toward the goal of promoting sustainable development worldwide into the twenty-first century.

Agenda 21 and one or more of the proposed conventions may be ready for signing at Rio. The diverse scope of the Rio Conference ensures that new landmarks in international cooperation will be achieved.

occur, substantial negative effects could include changes in sea level, frequency and intensity of storms, soil moisture, precipitation patterns, and incidence of droughts. Many critical aspects of the predicted warming phenomenon remain unclear, including the timing, extent, and regional distribution of climate changes, as well as feedback relationships and the roles of clouds, oceans, and biota. Recent temperature trends do not verify that an enhanced greenhouse warming is taking place, nor do they rule out such warming.

Greenhouse gases are emitted by various sources and stored in biological or chemical "sinks." Sources and sinks include the burning of fossil fuels such as coal and oil, industrial processes, changes in forest cover and land use, agricultural practices, and biodegradation of wastes. Greenhouse gas emissions occur in all nations; the National Academy of Sciences estimated in 1983 that about one-fourth of worldwide carbon dioxide emissions from fossil fuel combustion is contributed by the United States, one-fourth by Western Europe

U.S.-Asia Environmental Partnership

In January 1992 President Bush announced a new U.S.-Asia Environmental Partnership designed to improve both the environment and economic growth of Asian nations through four components:

- **Technology cooperation.** A U.S. Environmental Business Center is planned for the Asian region to promote U.S. environmental equipment and technology, provide information on trade, investment opportunities, and financing programs, and promote linkages between U.S. and Asian business communities.
- **Infrastructure.** The partnership will provide U.S. assistance for environmental infrastructure in the Asian region, including water supply and treatment facilities; clean, efficient powerplants; and production of lead-free fuels.
- **Fellowships and training.** Exchanges of senior-level managers and scholars will develop solutions to key pollution and conservation problems in Asia.
- **Regional biodiversity conservation network.** This program component will help countries and communities analyze, conserve, and use Asian forest and marine resources.

More than 25 Asian countries are eligible to participate in the partnership, which will be coordinated in the United States by an interagency working group chaired by the U.S. Agency for International Development and the Department of Commerce.

and Japan, one fourth by the former Soviet Union and Eastern Europe, and one-fourth by developing countries. Since that time, industrialized country shares have been declining relative to those of developing countries.

Forests and Biodiversity

The annual rate of deforestation in tropical countries, arising primarily from conversion of forestland to other uses, has increased from 9.2 million hectares to 16.8 million hectares per year. Tropical forests cover just 6 percent of the Earth's surface but are home to perhaps half of the planet's plant and animal species. Such species not only have intrinsic value but also are the source of commercially valuable foods, fibers, spices, woods, pharmaceuticals, and oils and resins used in cosmetics, soaps, and finishes. Tropical forests also play a key role in regional water cycles and in global climate patterns. When forests are cleared by burning, large amounts of greenhouse gases are released.

Due in large measure to the uncontrolled loss of tropical forests and other habitat conversions, the worldwide rate of extinction of species may currently exceed 1,000 times the natural rate. Extinctions of species and destruction of ecosystems are not problems restrict-

ed to the Tropics, however. While large gaps exist in scientific knowledge and measurement of biodiversity, existing information indicates losses of native species in every region of the United States.

Policies and Programs

A number of landmark international accords and scientific findings in recent years reflect intensified international environmental activities. Among the leading fora for international actions are the General Assembly and specialized agencies of the United Nations, OECD, bilateral talks between individual governments, and the annual summit meetings of seven leading industrialized nations, called the G-7: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

Major issues addressed by the United States in 1991 included the following, listed in alphabetical order.

Antarctica. In October 1991 the United States and most other Antarctic Treaty Parties signed a Protocol on Environmental Protection containing provisions on the conservation of fauna and flora, waste disposal, marine pollution, environmental impact assessment, and protected areas. The Protocol also prohibits mineral resource activities for at least 50 years.

The Arctic. In June 1991 the United States joined seven other Arctic-rim nations in signing a declaration on Arctic environmental protection and in adopting an Arctic environmental protection strategy. The signatories agreed to cooperate in the areas of pollution, marine environmental protection, emergency response, conservation of flora and fauna, and in research and monitoring.

Biodiversity. The United States is negotiating with 75 other nations through the United Nations Environment Programme for a convention on conservation of biodiversity to be signed in the near future. Though consideration has been given to a global biodiversity convention since 1987, formal substantive negotiating sessions began on a regular basis in February 1991 and continued in July, October, and December. In the December round, negotiators improved the possibilities of having a convention open for signature at the 1992 UNCED conference. Remaining questions focus on the regulation of biotechnology, funding, and financial mechanisms.

In addition to the convention, the United States is involved in creating a global conservation action plan for biodiversity to be included in the UNCED Agenda 21.

Canada. In March 1991 the United States and Canada signed an Air Quality Agreement which called for deep reductions in emissions of acid rain precursors, principally sulfur dioxide, and set up arrangements for addressing the full range of transboundary air quality issues.

Driftnet fishing. In December 1991 the United States was the principal cosponsor of a U.N. General Assembly resolution that called for a global moratorium on high seas driftnet fishing by December 31, 1992. Driftnet fishing is a highly destructive fishing technique that results in large incidental takes of marine mammals, seabirds, and other living marine resources.

Eastern and Central Europe. Building on existing bilateral accords and using funds provided under the Support for Eastern European Democracy Act of 1989, the United States assisted countries in the region with the

development of environmental legislation and policy institutions. The United States also directed technical assistance to combat air and water pollution, expanded regional cooperation on transboundary issues, and provided technical support to enhance nuclear safety. Much of this work was undertaken in cooperation with the Budapest Regional Environmental Center established in 1990 with U.S. help. Going beyond the large debt reduction for Poland previously agreed upon by the Western creditor governments, in July 1991 the United States provided an additional 10 percent reduction of Poland's debt to enable its government to fund a Polish environmental foundation.

Enforcement. In 1990 and in 1991 the United States brought the first successful prosecutions in the world to enforce domestic obligations in implementing the Montreal Protocol on Substances that Deplete the Ozone Layer. Similarly successful prosecutions in these two years resulted in criminal convictions of persons whose trade in endangered species violated U.S. laws implementing the Convention on International Trade in Endangered Species and of those who exported hazardous wastes from the United States without the prior consent of the receiving country.

Global climate change. In 1991 the United States continued its active involvement in research and in domestic and international policy development on global climate change.

- **Research.** The United States maintains the world's largest global climate change research program, with $1.37 billion in funding requested for fiscal 1993.
- **Climate change strategy.** The Climate Change Strategy outlined by the Bush Administration in 1991 and expanded in February 1992 includes implementation of the 1990 Clean Air Act Amendments, the National Energy Strategy, and other initiatives that collectively reduce projected net greenhouse gas emissions. These policies also will provide benefits in the areas of energy conservation, air quality, and improved forests and wildlife habitat. The United States aims to join other countries in signing a comprehensive, flexible framework convention at UNCED in June 1992.
- **Global framework convention.** In February 1991 the United States hosted the first session of the U.N. Intergovernmental Negotiating Committee for a Framework Convention on Climate Change and participated in three subsequent negotiating sessions. To assist developing countries in preparing to meet obligations under such an agreement, the United States committed $25 million over two years for inventories of greenhouse gas emissions and examination of response options.

Global Environment Facility. The Global Environmental Facility (GEF) was established in 1990 as a 3-year pilot project whose financial and other resources will be used to assist developing countries in the protection of the global environment. The United Nations Development Programme, the United Nations Environment Programme, and the World Bank are co-managers of GEF. GEF is expected to demonstrate innovative means for assisting developing countries in four issue areas: reducing greenhouse gas emissions, protecting the ozone layer, conserving biodiversity, and protecting international water resources.

National Climate Action Plans

In December 1991, at the fourth session of the U.N. Intergovernmental Negotiating Committee for a Framework Convention on Climate Change, the United States proposed development of national climate action plans to reduce or alleviate projected impacts of global climate change. To demonstrate the advantages of the plans over competing proposals, the United States made two unilateral commitments:

- To share with other negotiating parties before June 1992 measures that might be included in the first U.S. action plan; and
- To release a complete draft of the U.S. action plan within one year after the signing of the convention—an action-forcing deadline sooner than those in competing proposals.

The U.S. delegation argued that country-specific plans would be a more effective policy instrument for the convention than one-size-fits-all measures such as emissions stabilization targets. Plans would be comprised of specific measures undertaken by national, state, and local governments and the private sector. Based on assessments of current and projected levels of net greenhouse gas emissions, they would take into account relevant economic, social, and other policy parameters in a country. Using the best available science, each country would quantify, to the extent possible, anticipated reductions in projected net greenhouse gas emissions. Unlike emissions targets and timetables chosen arbitrarily by political leaders, national climate action plans would be rooted in actual response measures. They would allow many nations with widely different economies to join in the solution to a global problem and build the domestic and international foundations for tougher action should that be necessary in the future.

Recently the United States committed $50 million to the core fund of the revised GEF, in addition to $150 million previously pledged in parallel financing over three years through the U.S. Agency for International Development. The United States has worked with the other participating governments and the implementing agencies to structure the facility and in 1992 will participate in discussions on its future role and governance.

Latin America and the Caribbean. The Enterprise for the Americas Initiative (EAI), launched by President Bush in June 1990, aims to expand free trade in the Western Hemisphere, stimulate economic reform and investment liberalization, and ease the debt burden of Latin American and Caribbean nations. The debt reduction pillar of EAI includes an innovative mechanism to support environmental protection and conservation. Each country that benefits from a reduction of its bilateral debt owed to the U.S. government can pay interest on the remaining debt in local currency into trust funds that will sup-

port grassroots environmental projects. Through the negotiation of environmental framework agreements, the United States and each debtor country will set up administering bodies to make decisions about the use of these funds. Local nongovernmental organizations will play a prominent role on these bodies and the U.S. Environment for the Americas Board, composed of public and private representatives and formed in the fall of 1991, will provide general oversight of the program. In the past year, EAI environmental framework agreements have been signed with Bolivia, Chile, and Jamaica.

Marine environment. In 1991 the United States ratified a number of international conventions for the protection of the marine environment. In June the U.S. Senate ratified Annex III of MARPOL, the International Convention for the Prevention of Pollution from Ships, which regulates the shipping, packaging, and labeling of hazardous substances shipped in packaged form. With U.S. ratification, a sufficient number of nations had signed the treaty to bring it into force internationally in mid-1992. Rulemaking is underway to carry out the treaty provisions in the United States.

The U.S. Senate also ratified the International Convention on Oil Pollution Preparedness, Response, and Cooperation, which provides for a world wide network of expertise and resources to prevent and respond to oil spills. This framework was tested successfully in the international response to Iraq's massive release of oil into the Persian Gulf in January 1991. Although the convention had not yet been ratified, the International Maritime Organization and its member states used the provisions of the agreement as their template in coordinating international assistance efforts. The U.S. Coast Guard, Environmental Protection Agency, National Oceanic and Atmospheric Administration, Army Corps of Engineers and other federal agencies participated in efforts to assist the government of Saudi Arabia in meeting this environmental disaster.

The U.S. Senate also ratified the 1989 Salvage Convention, which provides for the compensation of persons who take steps to protect the environment while salvaging a ship or cargo at sea. The United States also adopted the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, which sets standards for ship officers and crews in an effort to reduce accidents at sea.

Mexico. In 1991 Mexico and the United States began work on an Integrated Environmental Plan for the U.S.-Mexico Border Area, building on a 1983 Border Environment Agreement. The United States also prepared a review of U.S.-Mexican environmental issues, with emphasis on the possible environmental effects of a North American Free Trade Agreement involving the United States, Mexico, and Canada, as proposed by President Bush in 1989.

Multilateral development banks. The United States worked with the World Bank and other multilateral development banks to integrate environmental considerations in lending practices. Efforts focused on environmental impact assessment procedures, energy efficiency and conservation programs, sensitive or endangered ecosystems, and public participation.

Ozone layer depletion. Signatories to the Montreal Protocol and its 1990 amendments have agreed to phase out the production of chlorofluorocar-

Persian Gulf Environmental Crisis

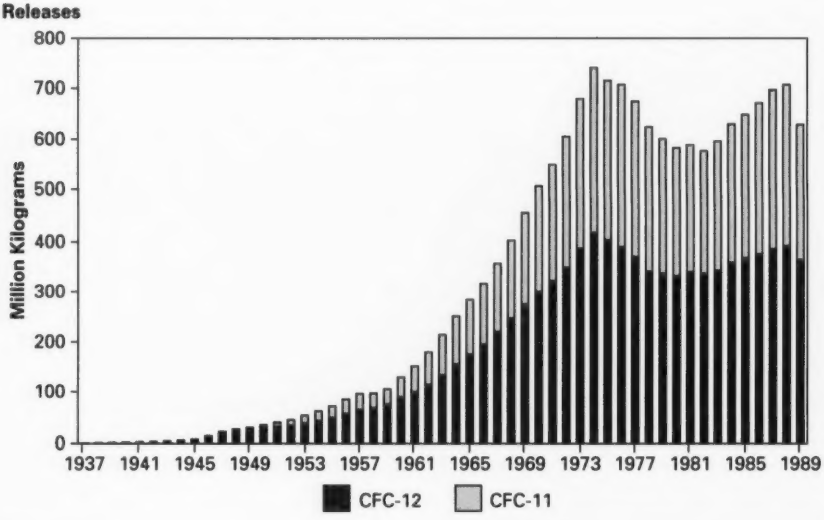
In January 1991, during hostilities provoked by the Iraqi invasion of Kuwait, Iraqi dictator Saddam Hussein ordered a massive oil discharge into the Persian Gulf in an effort to prevent amphibious landings by United Nations coalition forces. The discharge was estimated to be 6 million to 8 million barrels of crude oil, up to 30 times more oil than was spilled in the 1989 *Exxon Valdez* incident. During their retreat from Kuwait, Iraqi forces also torched or damaged over 700 oil wells.

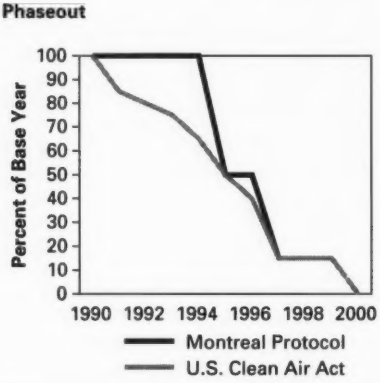
Personnel from more than 15 U.S. government agencies joined in an immediate international response, but it will take years of continued effort to assess and repair the damage to the environment. Preliminary data from various missions indicated that most of the damage will be confined to the Persian Gulf region and that carbon dioxide emissions from the oil fires are not likely to have a significant impact on global climate. The long-term effects of the crisis on human health and the environment are under study and review; however, to date, monitoring of hospital records indicates no widespread acute health impacts.

P.J. Griffiths/Magnum, Bechtel Group, Inc.

As part of an international environmental restoration effort, U.S. experts helped quell the oil field fires in Kuwait.

Global releases and scheduled phaseout of chlorofluorocarbons (CFCs).





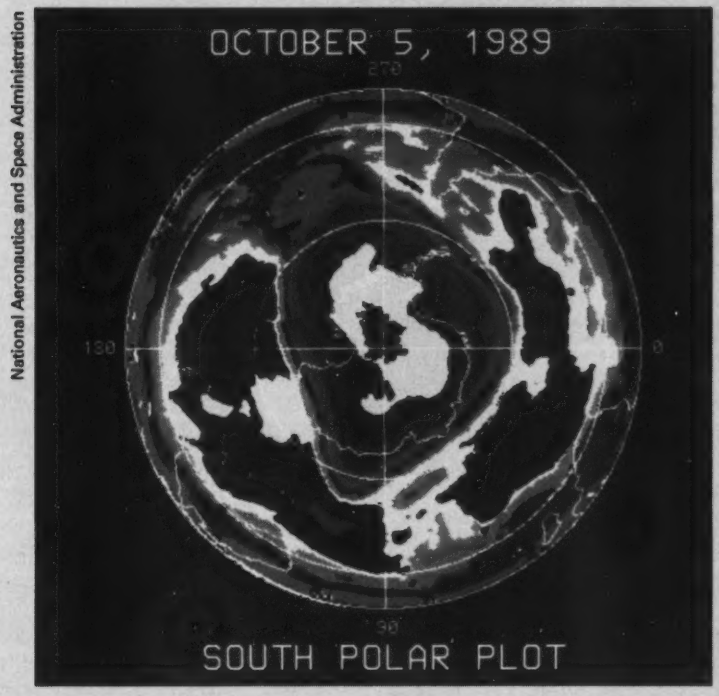
Source: See Part II, Table 44; Article 2A-2E, Montreal Protocol text; and Title VI of the Clean Air Act Amendments of 1990.

bons (CFCs) and most other ozone-depleting substances by the end of the century. However, in response to sound scientific evidence indicating that ozone depletion is occurring more rapidly and widely than previously believed, President Bush in February 1992 accelerated the U.S. phaseout deadline to the end of 1995, four years ahead of the Montreal Protocol deadline. Since fewer than 20 nations have ratified the London Amendments to the Montreal Protocol, the President called on other nations to match the U.S. commitment by ratifying the amended Protocol and accelerating their phaseout schedules.

To accelerate progress in the near term, the President has asked U.S. producers to cut 1992 output to one-half of 1986 levels. Under existing law, producers are allowed to be at 80 percent of 1986 levels in 1992. Due in large part to the use of innovative market-based mechanisms such as fees and tradable allowances, U.S. production of CFCs is already 42 percent below 1986 levels, a reduction beyond that required by the 1990 Clean Air Act Amendments and the Montreal Protocol.

Parties to the Protocol created the Interim Multilateral Fund in 1990 to assist developing countries undergoing the transition to the use of CFC-replacement technologies. Total contributions

Ozone Distribution over Antarctica



This southern hemisphere map shows the total ozone distribution for October 5, 1989. The lowest recorded ozone level was reached on this date in October of 1987. However, the minimum ozone in 1989 was only marginally higher than the record low level. This ozone hole was 80 percent larger than the Antarctic continent. Data were taken with the Total Ozone Mapping Spectrometer (TOMS) instrument on the NASA NIMBUS-7 satellite.

to this voluntary 3-year fund have risen from $160 million in 1991 to $200 million in 1992 and are expected to reach $240 million in 1993. Total U.S. contributions, 25 percent of the fund, could reach approximately $50 million. U.S. government and academic experts also continue their leading role in ozone assessment activities provided for under the Montreal Protocol, generating valuable new information for policymakers about the rate and extent of stratospheric ozone depletion.

South Pacific. In June 1991 the United States ratified the Convention for the Protection of the Environment in the South Pacific. Under the agreement, countries of the region are cooperating in addressing water treatment problems, management of coastal zones and wastes, lagoon and coral reef restoration, and climate change issues.

Soviet Union and successor states. During a period of fundamental political upheaval in the former Soviet Union and its successor states, American experts worked with their foreign counterparts to create an energy efficiency center in Moscow, conduct joint studies on reducing methane leakage from natural gas pipelines, monitor the Arctic environment, establish compatible environmental information systems, and implement plans for a joint international park in the Bering Sea region. In addition, the United States increased its technical assistance to the former Soviet Union to enhance nuclear safety measures.

Technology cooperation. The United States promoted the transfer of environmentally sound technologies and know-how to developing countries and those whose economies are in transition from centrally planned to market-based economies. Programs targeted environmental needs assessment, information dissemination, cooperative research and development, monitoring and evaluation, institution-building, technical assistance projects, and education and training. The United States also called for greater international emphasis on technology cooperation by the OECD and by the various agencies and bodies of the U.N. system.

Trade and the environment. Concern over the relationship between international trade and the environment was heightened in 1991 by the report of a dispute resolution panel convened under the General Agreement on Tariffs and Trade (GATT). The conflict involved the U.S. Marine Mammal Protection Act, which bans the import of tuna from countries whose fishing fleets have an incidental catch of dolphin in excess of U.S. dolphin mortality standards. The GATT panel declared that the U.S. law violates international rules against discriminatory trade practices. To help resolve this and other potential conflicts between environmental and trade laws, the United States is an active participant in the GATT Trade and Environment Working Party, which began meeting in late 1991. The United States is also participating in OECD efforts to develop guiding principles in this area.

Turkey. Fulfilling a commitment made by President Bush during the Iraq-Kuwait crisis, the United States and Turkey launched a program to increase technical cooperation between the two countries in environmental matters. Initially, activities will focus on four areas: training in environmental policy, including enforcement and environmental impact assessment; technical cooperation in solid and hazardous waste management; infrastructure development, information and monitoring systems; and exchange programs between the U.S. EPA and the Turkish Environment Ministry.

Mission to Planet Earth

Document and define changes in the natural environment, including plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes...

National Environmental Policy Act, section 204(6)

Also see International Issues and related tables and figures in Part II.

The National Aeronautics and Space Administration (NASA) is directing an international program called Mission to Planet Earth (MTPE) to obtain the scientific knowledge needed to predict changes in the environment. NASA and its interagency and international partners are placing satellites with advanced sensors in strategic Earth orbits to gather multidisciplinary data. A sophisticated data system will process and archive an unprecedented amount of information about the Earth and how it works as a system.

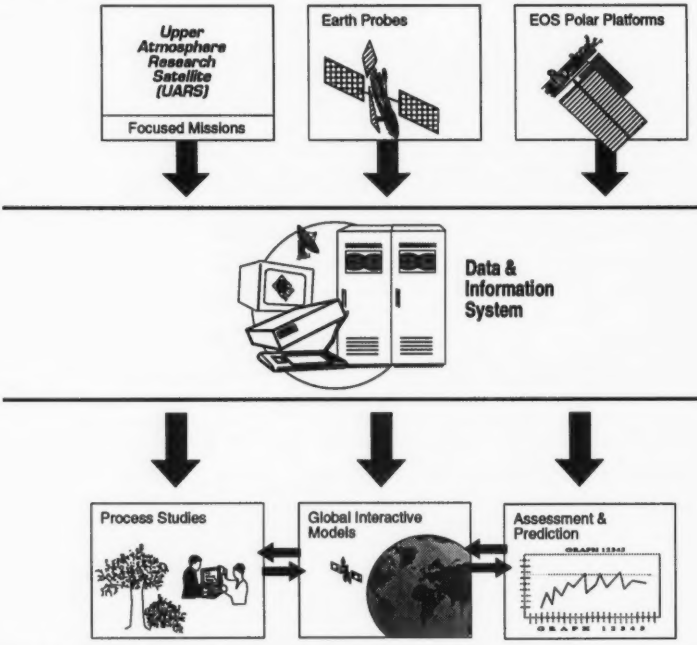
Conditions and Trends

Long-term measurements over the past several decades have documented a rapid rise in atmospheric concentrations of carbon dioxide, methane, nitrous oxide, and other heat-trapping greenhouse gases. Global warming, rising seas, deforestation, desertification, ozone depletion, and loss of biodiversity are potential outcomes of these changes that could have a profound impact on all nations. Yet many scientific questions remain unanswered. For example, global cloudiness, concentrations of atmospheric dust particles, and ocean circulation patterns are factors that may enhance or offset global climate trends. Existing systems for global monitoring and modeling of Earth's complex natural processes are inadequate to predict the magnitude and timing of environmental change. To the extent that the nation improves its abilities to monitor such changes, U.S. policymakers will be able to respond more effectively.

Policies and Programs

Mission to Planet Earth uses space- and ground-based measurement systems to augment the scientific basis for understanding global change.

Comprehensive components of Mission to Planet Earth.



Source: National Aeronautics and Space Administration, 1991.

Flight Programs

The space component of MTPE consists of platforms stationed in a variety of orbits, since no single orbit permits the gathering of complete information on Earth processes. A number of flight programs are currently in operation, others are under development, and yet others are being planned for the future.

Earth Observing System (EOS). The centerpiece of NASA contributions to MTPE is this series of polar-orbiting platforms for long-term global observations of the Earth's land, biosphere, atmosphere, and oceans. Combined with polar-orbiting platforms from Europe and Japan, EOS will form a comprehensive international system. Through a joint Space Station Program, NASA and the European Space Agency will provide polar platforms to EOS and its partner programs for at least 15 years. EOS will develop and operate remote-sensing instruments and conduct interdisciplinary investigations using data from these instruments. The program will advance knowledge in the fundamental physical, chemical, and biological phenomena that govern and integrate the Earth system.

Total Ozone Mapping Spectrometer (TOMS)/Meteor-3. In August 1991 this U.S. instrument that measures the concentration of ozone in the upper atmosphere was launched on a Soviet meteorological satellite. Measurements will supplement and continue those being taken by the TOMS still operating on the NIMBUS-7 satellite launched in

The Upper Atmosphere Research Satellite (UARS).

Source: National Aeronautics and Space Administration, 1991.

1978. TOMS instruments will fly on a NASA explorer-class satellite in 1993 and on Japan's Advanced Earth Observation Satellite (ADEOS) in 1995 to ensure the continuity of global ozone measurements.

Upper Atmosphere Research Satellite (UARS). Launched in September 1991, UARS carries instruments to study the global distribution of stratospheric ozone and other trace gases to understand chemical processes in the Earth's upper atmosphere.

Earth Radiation Budget Experiment (ERBE). A program to investigate the heating and cooling of the atmosphere, ERBE uses instruments launched in 1984 and 1985 on various satellites.

TOPEX/Poseidon. Scheduled for launch in mid-1992, this U.S.-French ocean topography experiment will study ocean circulation and its influence on the global environment.

Shuttle Imaging Radar-C (SIR-C). Scheduled for deployment on

Shuttle Imaging Radar.

Source: National Aeronautics and Space Administration, 1991.

NASA space shuttle missions in 1993 and beyond, SIR-C and the Atmospheric Laboratory for Applications and Science (ATLAS) are advanced spaceborne instrument-development campaigns. SIR-C is a device that can take x-ray-like pictures down to the level of bedrock and can help to locate and inventory freshwater resources.

Radarsat. NASA plans to launch this Canadian satellite in 1995. Radarsat will carry a synthetic aperture radar instrument to study the Earth's polar regions.

Earth Probes Program. A major component of MTPE, Earth Probes are specialized satellites that address specific Earth science needs. Earth Probes began flying in 1991, and the program calls for the launch of a satellite every two to three years. President Bush's fiscal 1993 budget proposal calls for the following Earth Probes:

- **Sea Wide Field Sensor (SeaWiFS).** Scheduled for launch in 1993, this ocean color sensor will study ocean productivity and interactions

between the ocean and the atmosphere.

- **Scatterometer.** Scheduled for launch on Japan's ADEOS satellite in 1995, this NASA instrument will study the ocean's surface to determine wind patterns and air-sea interaction.
- **Tropical Rainfall Measurement Mission (TRMM).** A U.S.-Japanese program scheduled for launch in 1997, TRMM will make extensive measurements of precipitation in tropical regions that cannot be time-sampled adequately from polar orbit.

Cooperative Research. NASA scientists also conduct research using data from satellites operated by the Department of Commerce/National Oceanic and Atmospheric Administration (NOAA) and the Department of Defense, as well as by counterpart environmental monitoring agencies around the world.

Data and Information System

The EOS Data and Information System (EOSDIS), being designed through competitive studies by industry with contributions from the scientific community, will link NASA space-based research elements of Mission to Planet Earth. By accessing information on a timely and nondiscriminatory basis, EOSDIS will interface with interagency and international networks and systems. By providing computers for NASA-sponsored EOS scientists, the system will ensure that instrument measurements are processed as meaningful information. EOS land-surface data will be processed and archived in Sioux Falls, South Dakota, at the U.S. Geological Survey (USGS) Earth Resource Observation Data Center, which houses the U.S. Landsat archives. NOAA will manage and archive a significant portion of the oceanic and atmospheric data.

In the United States, EOSDIS is being tied to a larger Global Change Data and Information System (GCDIS). Government agencies with global change data are cooperating on a design that will connect their catalog systems, quality assurance methods, procedures, and common services and provide a comprehensive directory of existing data and information products.

NASA is working with NOAA and other satellite operators and data processors to establish common approaches for data formats, directories, sensor calibration, documentation, and network connections. Participants provide access to research data on affordable terms as a condition for participation. The United States provides data to global change researchers for the marginal cost of fulfilling the request. Data desired by the environmental monitoring community eventually may be distributed without charge, with nations defining the terms for commercial use. All nations, including those that are not space-faring, can contribute research in return for low-cost data access.

Interdisciplinary Research

To forge new alliances among scientific disciplines, MTPE requires scientists to form interdisciplinary teams that address global issues. Scientific instruments aboard spacecraft are not limited to observations of value to only one discipline, and data interpretation typically requires teams of specialists. To obtain the long-term data scientists need and to make it available to all users, MTPE will produce global maps of surface temperature, precipitation, soil moisture, clouds, forest, desert, and

atmospheric ozone. Hundreds of scientists will participate, including the next generation of Earth scientists, many of whom will be trained and supported under NASA Earth science fellowships.

International Cooperation

The Committee on Earth Observations Satellites (CEOS) is the forum for multilateral international coordination. The committee coordinates the requirements of international science programs with the observation plans of space agencies. The CEOS Working Group on Data advocates common data formats for similar sensors flying on different satellites, intercalibration of data from different sensors, coordination of instrument validation, and international data directories. The CEOS Working Group on Calibration and Validation is undertaking instrument calibration and validation campaigns.

National Environmental Policy Act

Identify and develop methods and procedures, in consultation with the Council on Environmental Quality...which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations...

National Environmental Policy Act, section 102(B).

The National Environmental Policy Act of 1969 (NEPA) established substantive goals and procedural requirements to ensure that the federal government uses "all practicable means and measures...to create and maintain conditions under which man and nature can exist in productive harmony...." (42 U.S.C. § 4331[a] (1982)). The Council on Environmental Quality (CEQ) was created to oversee NEPA implementation by the federal agencies. Today as the law enters its third decade, the role of NEPA in federal decisionmaking is pervasive and significant.

Conditions and Trends

NEPA requires federal agencies to consider the environmental impacts of their proposed major actions, weighing alternatives and seeking public participation in the course of the process. The emphasis on early consideration of environmental concerns helps ensure that negative impacts are avoided or minimized.

To document their analysis, agencies must prepare either an environmental assessment (EA) or an environmental impact statement (EIS), which assesses the environmental impacts of the proposed action and alternatives. The level of documentation depends upon the significance of the identified environmental impacts. Classes of actions that normally do not have significant environmental impacts are categorically excluded from documentation requirements.

While virtually all federal agencies have adopted regulations to ensure that NEPA procedural requirements are met, patterns of compliance vary widely. For example, some agencies have difficulties integrating environmental values in pursuit of their more immediate, mission-oriented goals. Another factor is that environmental review requirements have proliferated with the enactment of subsequent environmental laws, making compliance more complex. Other influ-

NEPA Glossary

The National Environmental Policy Act of 1969 (NEPA) requires agencies to consider the environmental impacts of major federal actions, weigh alternatives, and seek public participation early in the planning process. The following are terms introduced by NEPA regulation promulgated by CEQ:

- **Environmental Assessment (EA).** A concise public document that analyzes the environmental impacts of a proposed federal action and provides sufficient evidence to determine the level of significance of the impacts.
- **Finding of No Significant Impact (FONSI).** A public document that briefly presents the reasons why an action will not have a significant effect on the human environment and therefore will not require the preparation of an environmental impact statement.
- **Environmental Impact Statement (EIS).** The "detailed statement" required by NEPA when an agency proposes a major federal action significantly affecting the quality of the human environment. An EIS must include an analysis of reasonable alternatives to the proposed action.
- **Record of Decision (ROD).** A public document that reflects the agency's final decision, rationale behind that decision, and commitments to monitoring and mitigation.

ences on NEPA implementation include legal decisions, international negotiations, and congressional proposals to amend NEPA itself. Current NEPA trends are presented at the end of this section.

In enacting NEPA, Congress did not intend for national environmental policy to override all other policies. Instead, lawmakers sought an accommodation among competing priorities. Properly implemented, NEPA facilitates that process, providing both an overall environmental policy and a process through which that policy can be integrated with other vital national objectives. Under the direction of a reinvigorated CEQ, cooperative efforts are underway with federal agencies to resolve difficult issues in NEPA implementation and improve the usefulness of the law as an efficient, integrative policy planning tool.

Policies and Programs

The concept of NEPA integration actually involves two goals: first, the consolidation of numerous environmental review requirements under the NEPA process, and second, the integration of NEPA substantive objectives into decisionmaking. Chapter 5 of *Environmental Quality: The 21st Annual Report of the Council on Environmental Quality* contained an in-depth discussion of NEPA integration.

CEQ Oversight

The following examples illustrate CEQ efforts to promote NEPA integration.

NEPA integration workshop. In March 1991 CEQ and the Environmental Protection Agency (EPA) convened

a workshop entitled "NEPA Integration: Effective, Efficient, Environmental Compliance in the 1990s." Participants, representing federal and state agencies, businesses, and public interest organizations, considered integration questions in the context of transportation, natural resources, energy, and commercial development.

Superfund/NEPA integration workshop. In July 1991 CEQ, EPA, and the departments of Defense, Agriculture, Energy, and Justice participated in a workshop on ways to integrate the NEPA process with the environmental reviews required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). The Superfund law, enacted in 1980 and amended in 1986, directs federal agencies to clean up hazardous waste sites on federal property and requires detailed investigation and feasibility studies. Attendees explored requirements and values of both the NEPA and CERCLA processes and sought ways to eliminate redundant effort and paperwork.

NEPA compliance survey. CEQ regulations require federal agencies, when preparing an EIS, to state how each alternative under consideration will or will not achieve NEPA environmental policy goals (40 C.F.R. § 1502.2[d]). Because this requirement is crucial in linking the NEPA substantive mandate to the environmental impact statement process, CEQ reviewed a random sample of final EISs and conducted a survey of the agencies involved in preparing those documents. The survey showed that some agencies do not include NEPA goals in analyzing alternatives, which suggests that these agencies view the NEPA process as merely a paperwork requirement before proceeding with a decision. The 1991 survey showed the following key factors in NEPA "success" stories:

- Personal involvement by the decisionmaker in the EIS process,
- Early and frequent communication with interested parties,
- Clear agency standards of acceptability, and
- Creative approaches to alternatives.

Model NEPA programs. CEQ is frequently asked for models of successful NEPA compliance. In 1992 CEQ will launch a program to identify occasions when an agency's NEPA compliance meets both the procedural requirements and the substantive environmental quality goals of the statute. These examples will be accorded official commendation and showcased in future editions of the CEQ annual report.

Agency Implementation

During the past year, agency implementation of NEPA regulations included the following developments:

Department of Defense. Following Iraq's invasion of Kuwait in August 1990, the President directed the rapid deployment of over 400,000 troops, plus the needed supplies and weaponry to support Operation Desert Shield and Operation Desert Storm. CEQ concurred with the Department of Defense (DOD) that activities in support of national security interests in the Middle East constituted an "emergency" situation, allowing DOD to establish alternative NEPA procedures (40 CFR 1506.11). Alternative procedures were used only twice, with close participation and oversight by CEQ, in situations involving limited testing of a fuel-air explosive in Nevada and changing flight operations at Westover Air Force Base

in Massachusetts. NEPA emergency procedures did not relieve the military services of their duty to conduct all other operations in full compliance with applicable federal, state, and local environmental laws.

Department of Energy. Pursuant to a 10-point directive by the Secretary of Energy, the Department of Energy (DOE) worked closely with CEQ to update NEPA procedures. The new DOE regulations replace earlier guidelines and strengthen compliance with the letter and spirit of NEPA.

USDA Forest Service. The Forest Service has worked with CEQ over the years in refining its NEPA regulations in response to constantly changing laws and experiences. Since publishing proposed revisions to its NEPA procedures in April 1991, the Forest Service has received over 2,000 public comments.

Agency workshops on NEPA implementation. Throughout 1991 a number of agencies, including DOE, the General Services Administration, the Department of Agriculture (USDA) Forest Service, and the Department of the Interior Minerals Management Service and Bureau of Land Management held workshops focused on NEPA implementation problems.

Snake River sockeye salmon and NEPA compliance. In April 1991 the National Marine Fisheries Service published a proposed determination that Snake River sockeye salmon met requirements to be listed as endangered under the Endangered Species Act. The Bonneville Power Administration (BPA) was asked by the Idaho Fish and Game Department and the Shoshone-Bannock Tribes to fund an effort to trap and collect smolts and any adults returning from the Pacific Ocean in an attempt to rebuild the sockeye salmon run in the Snake River Basin. CEQ worked closely with BPA and other interested government and private sector parties in developing alternative arrangements for compliance with NEPA in what was deemed an emergency situation (40 C.F.R. § 1506.11).

New and revised NEPA regulations. The following agencies have revised or published new NEPA regulations within the past year: the Interstate Commerce Commission, the Federal Energy Regulatory Commission, and the USDA Cooperative State Research Service and Soil Conservation Service.

Extraterritorial Application of NEPA

Although application of NEPA has been confined to the United States, the federal government recognizes that environmental problems cross international borders. Executive Order 12114, which took effect in 1979, mandates analysis of the environmental effects of major federal actions abroad. CEQ leads an interagency task force that is reviewing the effectiveness of the Executive Order. Additionally in February 1991 the United States signed a Convention on Environmental Impact Assessment with European countries, obligating the signatories to consult when an activity is likely to cause adverse transboundary environmental impacts. The Department of State, EPA, and CEQ are devising an implementation strategy for the convention.

CEQ/NEPA Legislation

In 1991 legislation was introduced to reauthorize the CEQ Office of Environmental Quality created by the Environmental Quality Improvement Act of 1971 to provide support for CEQ. The proposed legislation would amend NEPA for the following purposes:

Extraterritorial actions and impacts. Proposed legislation would require NEPA procedures for all major federal actions abroad. The bills would require agencies to address global impacts such as climate change and loss of biodiversity in their NEPA documents. Exceptions to these new policies would include actions taken to protect national security, votes in international conferences and organizations, actions taken in the course of armed conflict or strategic intelligence, arms transfers, or certain enforcement actions.

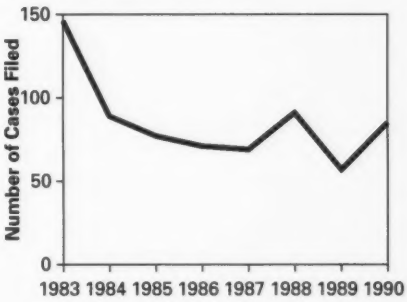
Evaluation of mitigation measures. Proposed legislation would require agencies to review the effectiveness of mitigation measures taken in accordance with commitments made in environmental impact statements and records of decision. The legislation would impose a substantive duty on federal agencies to mitigate adverse environmental impacts, and it would change CEQ annual reporting requirements.

Elimination of two Council seats. The legislation would implement a proposal adopted by President Bush at the suggestion of environmental advocacy groups to eliminate two member positions on the Council. Under this legislation, all powers, functions, and duties of the Council would be vested in the CEQ chairman.

Selected NEPA Cases in 1991

This section highlights NEPA-related decisions by federal circuit and district courts during 1991, which reflect major NEPA compliance issues.

NEPA cases filed.



Source: See NEPA Table 17-1.

Extraterritorial Application
Environmental Defense Fund v. *Massey* No. 91-1068 (D.C. Cir., Aug. 29, 1991).

In accordance with Executive Order 12114 on assessments of effects abroad of major federal actions, the National Science Foundation (NSF) prepared an environmental analysis for its proposal to incinerate food waste at its McMurdo Research Station in Antarctica. Plaintiff challenged the failure by NSF to prepare an EIS for its proposal, arguing that NEPA applied to extraterritorial actions such as the one proposed and challenging the sufficiency of the NSF analysis under the Executive Order.

The court found no clear Congressional intent to apply NEPA beyond the borders of the United States, and held that NEPA did not apply to the NSF decision to build waste incinerators in Antarctica. In addition the court held that Executive Order 12114 explicitly precludes a private cause of action. Plaintiff has appealed the District Court opinion.

Emergency Situations
Valley Citizens For A Safe Environment v. *Vest, et al.*
(D. Mass. May 6, 1991, unpublished).

In 1987 the Department of the Air Force issued an EIS evaluating the likely effects that the presence and operation of C-5A transport planes at Westover Air Force Base in Massachusetts would have on the environment. The EIS did not evaluate night flights. However in September 1990 the Air Force began night flights as a result of the crisis in the Persian Gulf. CEQ determined that the developing situation in the Middle East constituted an emergency within the meaning of its regulations and established alternative arrangements for NEPA compliance in those circumstances (40 CFR § 1506.11). Plaintiffs challenged the general authority of CEQ to permit alternative arrangements in an emergency and the specific application of the emergency regulation to the situation at Westover.

The District Court upheld both CEQ authority to promulgate regulations allowing for alternative arrangements in emergency circumstances and CEQ application of the regulation to Westover. The court first noted that section 102 of NEPA requires compliance "to the fullest extent possible," indicating that an EIS is not mandatory in all circumstances. The court also held that the decision by CEQ and the Air Force to deem the Westover situation an emergency was reasonable, given military operational and scheduling difficulties during "the hostile and unpredictable" Persian Gulf crisis.

Alternatives Analysis
Citizens Against Burlington v. *Busey*
938 F.2d 190 (D.C. Cir. 1991), petition for cert. denied, December 1991.

The Toledo Airport Authority in Toledo, Ohio, sought permission from the Federal Aviation Administration (FAA) to expand its local airport to accommodate a cargo hub. According to the airport authority, the cargo hub would create new jobs and provide new revenue for the local economy.

The FAA prepared an EIS for the proposed federal approval action and gave detailed consideration to only two alternative actions: the operation of the Toledo Airport as a cargo hub (the preferred alternative) and the no-action alternative. In its EIS, the FAA defined the objectives of the proposal as helping to establish a new hub in Toledo and helping the Toledo economy; alternative locations outside of the Toledo area were dismissed because they would not fulfill these objectives. After completion of the EIS, the FAA approved the cargo hub.

Plaintiffs challenged the FAA action, arguing, among other things, that FAA violated NEPA and CEQ regulations by not assessing other alternatives such as creating a cargo hub at Fort Wayne, Indiana. In upholding the FAA decision, the court recognized that the range of reasonable alternatives is limited by the purpose and need for the proposed action. The court stated that an agency's definition of the objectives of a proposed federal action should be upheld as long as the objectives the agency chooses are reasonable. Further an agency need follow only a rule of reason in preparing an EIS, and this rule of reason extends to both choosing

which alternatives the agency must discuss as well as the extent to which the agency must discuss them.

The dissent found this reasoning contrary to CEQ regulations, stating that FAA had failed to examine all practicable or feasible alternatives and that FAA had "the duty under NEPA to exercise a degree of skepticism in dealing with self-serving statements from a prime beneficiary of a project."

Interpretation of "connected" actions
Blue Ocean Preservation Society v. *Watkins* 754 F. Supp. 1450 (D. Hi. 1991).

The State of Hawaii developed the Hawaii Geothermal Project to consist of four phases: first, exploration and testing of geothermal resources; second, research regarding the feasibility of transporting the power via underwater cables; third, a program to drill exploration wells; and fourth, construction of separate geothermal powerplants. DOE provided funds for the first two phases. In October 1990 Congress appropriated an additional $5 million for use in Phase Three, the first of three such appropriations anticipated from Congress over the next three years. In conjunction with the 1991 Dire Emergency Supplemental Appropriations Bill, the conference committee stated that while Phase Three was "research" and therefore not a major federal action subject to NEPA, DOE should nevertheless earmark some of the funds for an EIS for the project. In May 1990 plaintiff sued DOE seeking to compel preparation of an EIS and to enjoin further federal participation in the project until the EIS was completed.

The court rejected the Congressional characterization of Phase Three and held that phases Three and Four were connected actions that must be considered in one EIS. The court further held that the research work contemplated by Phase Three easily satisfied the statutory standards for a "major federal action" based simply on the extent of federal funding.

Timing of an EIS
Public Citizen, Inc., v. *NRC*
No. 90-1432 (D.C. Cir. Aug. 2, 1991).

The Nuclear Regulatory Commission (NRC) published a final "policy statement" to provide a framework for making regulatory exemption decisions for practices that expose the public to radiation in such minute amounts as to be "below regulatory concern" (the BRC policy). In addition NRC shifted its policy toward two other factors affecting such a decision: it would no longer require social justification in exempting practices, nor would it strive for radiation exposure as low as reasonably achievable. Petitioners argued, among other things, that NRC violated NEPA because it did not prepare an EIS pursuant to 40 CFR 1508.18(b)(1): "official policies...adopted pursuant to the APA" (Administrative Procedures Act) and "formal documents establishing an agency's policies which will result in or substantially alter agency programs."

The court found that the NEPA challenge was premature. Agencies must have "considerable discretion in picking the right moment" to do an EIS. The court found that NRC validly claimed that its BRC policy was not mature enough to constitute a "proposal for action," that the policy statement "does not allow those in possession of

radioactive materials to change their conduct without first applying for an exemption, and that no exemptions will be granted automatically, so the BRC policy will have no effect" until NRC makes further decisions. The court also relied on the NRC statement that appropriate NEPA review would accompany any rulemaking associated with the implementation of the BRC policy. In June 1991 NRC imposed an indefinite moratorium on the implementation of the BRC policy in response to significant broad-based objection to the policy.

NEPA Trends

During 1990 a total of 85 legal cases were filed against federal departments and agencies on the basis of the NEPA, with 11 cases resulting in injunctions. The Department of Transportation was the most frequent defendant with 27 cases filed against it. The Army Corps of Engineers was next, with 10 cases, followed by the Environmental Protection Agency, with 8 cases.

The most common complaint continued to be "No environmental impact statement when one should have been prepared," which was the cause of action in 53 cases. The second most common complaint, "Inadequate environmental impact statement," appeared in 24 cases. The most frequent plaintiffs were environmental groups, filing 38 cases, followed by individuals or citizen groups.

In 1991 the number of draft, final, and supplemental environmental impact statements (EISs) filed by federal agencies dropped slightly from those filed in 1990. Federal agencies filed 456 EISs, continuing a downward trend over the past decade.

Abbreviations for Federal Agencies

ARMY	DOD Department of the Army
COE	DOD Department of the Army, Corps of Engineers
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
HUD	Department of Housing and Urban Development
ICC	Interstate Commerce Commission
NAVY	DOD Department of the Navy
NCPC	National Capital Planning Commission
NRC	Nuclear Regulatory Commission
STATE	Department of State
TREAS	Department of the Treasury
USDA	Department of Agriculture
USPS	United States Postal Service

Cumulative NEPA Litigation Survey, 1970-1990.*

Year	Cases filed	Injunctions	Most frequent defendant	Most frequent plaintiff	Most common complaint	Second most common complaint
1974	189		DOT, HUD			
1975	152					
1976	119		DOT, DOI, HUD	Citizen and Environmental Groups	No EIS	Inadequate EIS
1977	108		DOT, DOD, DOI	Citizen and Environmental Groups	No EIS	Inadequate EIS
1978	114		DOT, DOD, DOI, HUD, EPA	Citizen and Environmental Groups, Individuals	No EIS	Inadequate EIS
1979	139	12	DOT, HUD, DOI, USDA, DOD	Environmental Groups, Citizen Groups, and Individuals	No EIS	Inadequate EIS
1980	140	17	DOT, DOI, DOD, HUD, EPA	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS
1981	114	12	DOD, DOT, DOI, USDA, HUD, NRC	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1982	17	19	DOI, COE, DOT, USDA, HUD, EPA	Individuals or Citizen Groups, Environmental Groups	Inadequate EIS	No EIS
1983	146	21	DOI, DOT, USDA, FERC, NRC	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS

Litigation Survey, (continued)

Year	Cases filed	Injunctions	Most frequent defendant	Most frequent plaintiff	Most common complaint	Second most common complaint
1984	89	14	USDA, DOI, DOT	Environmental Groups, Individuals or Citizen Groups	Inadequate EIS	No EIS
1985	77	8	DOT, DOI, COE, FERC	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1986	71	16	DOT, DOI, USDA	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS
1987	69	3	DOI, DOT, USDA	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EA and EIS
1988	91	7	COE, USDA, DOI, DOT	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1989	57	5	USDA, DOT	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS
1990	85	11	DOT, COE, EPA	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS

* 1970-1975: A cumulative survey on these years was published in the 1976 CEQ Annual Report. By June 30, 1975, 332 NEPA cases had been completed, resulting in 54 injunctions; 322 cases were still pending with 65 injunctions. The most frequent defendants were the departments of Transportation and Housing and Urban Development.

Source: CEQ, 1991.

NEPA cases by agency, 1990.

Agencies	Number of cases filed	Number of 1990 cases resulting in injunctions	Number of injunctions in 1990 from pre-1990 cases
Environmental Protection Agency	8	1	0
Federal Energy Regulatory Commission	4	0	0
Interstate Commerce Commission	1	0	0
National Capital Planning Commission	1	0	0
Nuclear Regulatory Commission	4	0	0
United States Postal Service	1	1	0
Department of the Army	6	1	0
Department of the Army, U.S. Army Corps of Engineers	10	1	0
Department of Commerce	1	0	0
Department of Defense	2	2	0
Department of Energy	5	0	1
Department of Housing and Urban Development	2	1	0
Department of the Interior	6	0	2
Department of the Navy	5	1	0
Department of State	1	0	0
Department of Transportation	27	3	1
Department of Treasury	1	0	0
Total	85	11	4

Source: CEQ, 1991.

Types of complaints filed under NEPA, 1990.

Causes of action	Number for 1990 cases	Number for pre-1990 cases resulting in injunctions in 1990
Inadequate Environmental Impact Statement	24	2
No Environmental Impact Statement, when one should have been prepared	53	2
Inadequate Environmental Assessment	16	1
No Environmental Assessment, when one should have been prepared	8	
No Supplemental Environmental Impact Statement, when one should have been prepared	5	
Other	6	
Total	112	5

Source: CEQ, 1991.

Plaintiffs for NEPA lawsuits, 1990.

Types of plaintiffs	Number for 1990 cases	Number for pre-1990 cases resulting in injunctions in 1990
Environmental groups	38	4
Individuals or citizen groups	38	
State governments	5	
Local governments	9	
Business groups	5	
Property owners or residents	13	1
Indian tribes	2	
Other	2	
Total	112	5

Source: CEQ, 1991.

Statistics on plaintiffs and issues for 1990 cases, by federal agency.

Plaintiffs and issues	Federal agencies																
	EPA	FERC	ICC	NCPC	NRC	USPS	ARMY	COE	DOC	DOD	DOE	HUD	DOI	NAVY	STATE	DOT	TREAS
Plaintiff																	
Environmental groups	2	4					2	2	1	1	4	1	4	2	1	13	1
Individuals or citizen groups	4	2		1	3		3	7			1		2	5		9	1
State governments		1					1			1						2	
Local governments	3	1				1	1									3	
Businesses	1	1	1									1				1	
Property owners or residents		2		1	2			3				1			1	3	
Indian tribes								1					1				
Other		1		1													
Total	10	12	1	3	5	1	7	13	1	2	5	3	7	7	2	31	2
Issue																	
Inadequate EIS	2	2					2	3			1		3	1		10	
No EIS	6	1			3		4	6	1	2	4	2	3	2	1	17	1
Inadequate EA	1	1		1			2	1		2	3					5	
No EA					1	1		1						2		2	1
No supplemental EIS	1				1											3	
Other			1			1	1					1				2	
Total	10	4	1	1	5	2	9	11	1	4	8	3	6	5	1	39	2

Source: CEQ, 1991.

Environmental impact statements filed by federal agencies.

Agency	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Agriculture	172	104	102	89	59	65	117	118	75	68	89	136
Commerce	54	53	36	25	14	24	10	8	9	3	5	8
Defense	1	1	1	1	1	0	0	0	2	0	0	0
Air Force	8	3	7	4	6	5	7	8	9	6	11	19
Army	40	9	14	3	6	5	5	2	10	8	9	9
COE	182	150	186	127	119	116	106	91	76	69	40	46
Navy	11	9	10	6	4	9	8	13	9	6	4	19
Energy	28	45	21	24	19	14	4	13	11	9	6	11
EPA	84	71	96	63	67	42	16	18	19	23	25	31
GSA	13	11	13	8	1	0	4	0	1	3	0	4
HUD	170	140	140	93	42	13	15	18	6	2	7	5
Interior	126	131	107	127	146	115	105	98	110	117	61	68
Transportation	277	189	221	183	169	147	126	110	101	96	90	100
TVA	9	6	4	0	2	1	0	1	0	0	0	3
Other	98	44	76	55	22	21	26	15	17	20	23	18
Total	1,273	966	1,033	808	677	577	549	521	455	430	370	477

Source: U.S. Environmental Protection Agency, Office of Federal Activities, unpublished data, 1991.

Notes: Years refer to calendar years. Number of EISs includes draft EISs, EIS supplements, and final EISs filed during the specified year. Some proposed projects may have several draft and final EISs filed over a period of years. COE= U.S. Army Corps of Engineers. HUD=Department of Housing and Urban Development. EPA=U.S. Environmental Protection Agency. GSA=General Services Administration. TVA=Tennessee Valley Authority.

Environmental impact statements filed by federal agencies during 1991.

Agency	Totals by subject matter	Totals
Department of Agriculture		145
Natural gas and oil: drilling and exploration	5	
Natural gas and oil: transportation, pipeline, storage	1	
Power facilities: transmission	2	
Watershed protection and flood control	5	
Mining	1	
Irrigation, desalination of return flows, agricultural water supply	1	
Parks, recreation areas, wilderness areas, national seashores	19	
Forestry and range management	85	
Mining (non-energy)	11	
Pesticides and herbicide use	10	
Weather modification and methodology	2	
Dredge and fill	1	
Other water projects	2	
Department of Commerce		13
Wetlands, estuary and ocean use: sanctuary, disposal, and other	9	
Fisheries	4	
Department of Defense		
Department of the Air Force		20
Military installations: conventional, chemical, nuclear, and other	16	
Defense systems	4	
Department of the Army		21
Military installations: conventional, chemical, nuclear, and other	18	
Munitions facilities	2	
Forestry and range management	1	
Department of the Army, Corps of Engineers		45
Military installations: conventional, chemical, nuclear, and other	1	
Beach erosion, hurricane protection, river and lake bank stabilization	4	
Navigation	7	
Multi-purpose impoundments	6	
Dredge and fill	4	
Watershed protection and flood control	15	
Other water projects	3	
Bridge permits	1	
Parks, recreation areas, wilderness areas, national seashores	1	
Pesticides and herbicide use	1	
Fisheries	1	
Space programs	1	

EISs by agencies, (continued)

Agency	Totals by subject matter	Totals
Department of the Navy		7
Power facilities: conservation and other	1	
Military installations: conventional, chemical, nuclear, and other	4	
Dredge and fill	1	
Research and development (not already covered)	1	
Department of the Navy, Marine Corps		2
Military installations: conventional, chemical, nuclear, and other	2	
Department of Energy		2
Nuclear development: (fuel and other)	1	
Power facilities: transmission	1	
Environmental Protection Agency		16
Mining	1	
Hazardous and toxic substance disposal	1	
Sewage treatment and sewage facilities	4	
Municipal and industrial water supply systems not multi-purpose impoundments	1	
Mining (non-energy)	1	
Wetlands, estuary, and ocean use: sanctuary, disposal, and other	7	
Miscellaneous information	1	
General Services Administration		3
Buildings for federal use	3	
Department of Housing and Urban Development		7
Pesticide and herbicide use	1	
Buildings, federally licensed or assisted (including production facilities)	6	
Department of the Interior		64
Nuclear development (fuel reactors and other)	1	
Mining	2	
Natural gas and oil: drilling and exploration	8	
Municipal and industrial water supply system not multi-purpose impoundments	2	
Irrigation, desalination or return flows, agricultural water supply	1	
Multi-purpose impoundments	1	
Watershed protection and flood control	2	
Land acquisition or disposal, management jurisdiction transfer	4	
Parks, recreation areas, wilderness areas, national seashores	14	
Forestry and range management	9	
Mining (non-energy)	6	

EISs by agencies, (continued)

Agency	Totals by subject matter	Totals
Department of the Interior (continued)		
Comprehensive resource management	8	
Pesticides, herbicides use	1	
Housing subdivisions and new communities	2	
Drainage	1	
Wetlands, estuary and ocean use: sanctuary, disposal, and other	1	
Natural gas and oil: transportation, pipeline, storage	1	
Department of Transportation		87
Road construction	68	
Airport improvements	7	
Bridge permits	3	
Mass transportation	7	
Weather modifications and methodology	2	
Federal Energy Regulatory Commission		8
Natural gas and oil: transportation, pipeline, storage	5	
Power facilities: hydroelectric	3	
National Aeronautics and Space Administration		1
Space programs	1	
National Science Foundation		2
Research and development (not already covered)	2	
Nuclear Regulatory Commission		1
Nuclear development: fuel reactors and other	1	
Department of Justice		6
Prison construction	6	
Department of Veterans Affairs		6
Cemetery development	6	
Total federal EISs		456

Source: CEQ, 1991.

Pollution Prevention

Approach the maximum attainable recycling of depletable resources...
National Environmental Policy Act, section 101(6)

Also see Federal Facilities Management, Hazardous and Solid Wastes, Private Sector Initiatives, and related tables and figures in Part II.

One of the major themes of environmental protection in the 1990s is pollution prevention, the move to conserve natural resources by recycling them and preventing pollution before it is created. Many sectors of the economy—agriculture, industry, consumer products, federal facilities, energy, and transportation—have taken up the cause.

Conditions and Trends

While data remain in short supply, several trends are promising.

Recycling

In recent years, all but two states have enacted some type of recycling legislation. As recycling becomes more available in communities, and as the market for recycled goods expands, recycling increases its effective contribution to pollution prevention efforts.

In October 1991 President Bush signed Executive Order 12780, the Federal Recycling and Procurement Policy, which requires that federal agencies increase recycling and waste reduction efforts and encourage the market demand for recycled products by favoring the use of recycled materials

For a further discussion of recycling, see the Hazardous and Solid Wastes section in this report.

Toxic Chemicals

Although many pollution problems can be addressed by prevention efforts, much of the current U.S. emphasis is on reducing industrial toxic chemicals. From 1987 to 1989, releases and transfers of chemicals reported on the Environmental Protection Agency (EPA) Toxics Release Inventory (TRI) declined 18 percent, for a total of 1.3 billion pounds. Much of this decline can be attributed to pollution prevention measures undertaken by TRI industries. Nevertheless, 1989 data revealed that 22,560 facilities still released 5.7 billion pounds of toxic chemicals into the environment. Of this total, the facilities released 189 million pounds of toxic chemicals into rivers, lakes, streams,

and other bodies of water. They emitted 2.4 billion pounds into the air, disposed of 445 million pounds in landfills, and injected 1.2 billion pounds into underground wells. TRI facilities transferred an additional 551 million pounds to municipal wastewater treatment plants and 916 million pounds to treatment and disposal facilities.

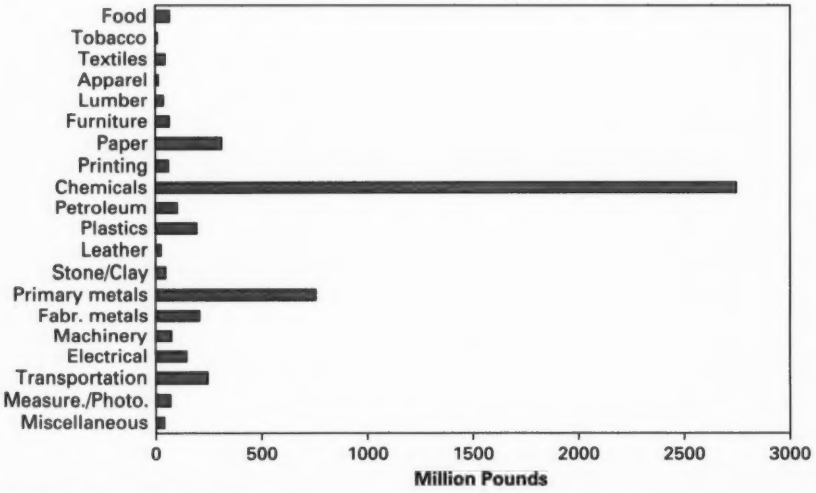
Although TRI continues to evolve as a prime indicator of pollution prevention trends, it has limitations. The inventory describes only the emissions of manufacturers, which are only a fraction of the national total, and it describes only toxic emissions, which are also only a fraction of the nation's waste problems. TRI reports on emissions or transfers after treatment rather than providing the pollution generation data need for prevention analysis. Under the Pollution Prevention Act of 1990, more data will be collected in the future on waste minimization.

Energy Efficiency

Electricity generation accounts for much of the air pollution in the United States. Across the country, utilities are undertaking electricity efficiency programs, which restrain energy demand growth and related emissions. For example, the Consolidated Edison Enlightened Energy Program aims to reduce overall usage of electricity in New York City and Westchester County by 15 percent and peak demand by 23 percent by 2008. Expenditures of $4 billion over 18 years will provide incentives to business customers to install energy-efficient lighting, air conditioning, and motors. Most states are adopting energy-efficiency programs and integrated resource planning (IRP) to varying degrees, and 23 states use full-fledged IRP practices.

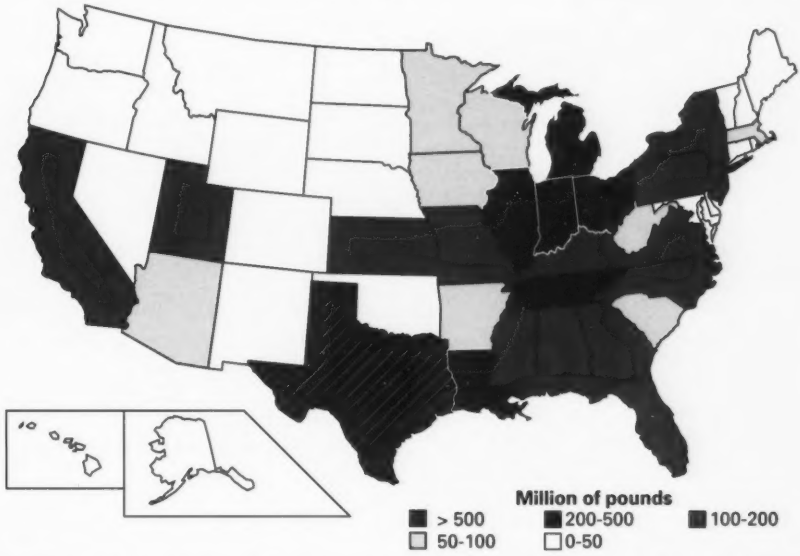
In April 1991 President Bush signed an Executive Order on Federal Energy Management Policy. This order

Toxic Release Inventory (TRI) releases and transfers.



Source: See Part II, Table 92.

TRI total releases and transfers, 1988.



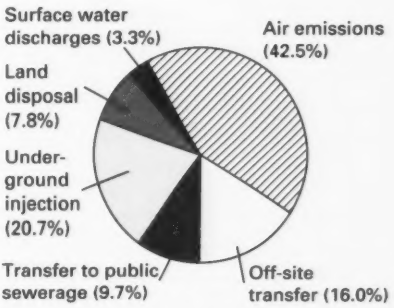
Note: Correlations between TRI releases and risks to human health and the environment depend on many variables.
Source: U.S. Environmental Protection Agency, *Toxics in the Community*, (Washington, DC: EPA, 1991), page 58.

makes several adjustments to increase federal energy efficiency, such as the promotion of alternative fuel use in federal buildings, a 20-percent increase in energy efficiency in federal buildings, and a 10-percent reduction in federal motor vehicle gas and diesel consumption.

Policies and Programs

In 1991 President Bush established by executive order the President's Commission on Environmental Quality (PCEQ). This 25-member private sector advisory group, chaired by the Council on Environmental Quality, adopted pollution prevention as a priority area for private sector demonstration projects. In addition to these and other private sector programs, federal pollution prevention advances in 1991 involved the Pollution Prevention Act, the Clean Air Act Amendments, and the cleanup of contaminated federal facilities.

Environmental distribution of TRI releases and transfers.



Source: See Part II, Table 92.

Environmental Protection Agency

In February 1991 EPA announced a Pollution Prevention Strategy that addresses manufacturing and chemical use, agriculture, energy (including transportation), and institutional changes within EPA. Among actions consistent with the strategy are the following:

33/50 Program. This EPA industrial toxics project encourages voluntary industrial reductions of toxic wastes to achieve an overall national reduction of 33 percent by 1992 and 50 percent by 1995. Reduction will be measured against 1988 TRI data. The program targets 17 priority toxic chemicals, which accounted for 1.4 billion pounds of TRI releases and transfers in 1988 and 1.3 billion pounds in 1989. In 1989 33/50 chemicals accounted for 23 percent of the total TRI releases and transfers. In a first round of contacts, EPA asked 600 TRI facilities, which in 1989 accounted for 79 percent (1.1 billion pounds) of the target chemicals, to take

Pollution Prevention Act

The Pollution Prevention Act of 1990 identified pollution prevention as a national objective and established the following waste management "hierarchy":

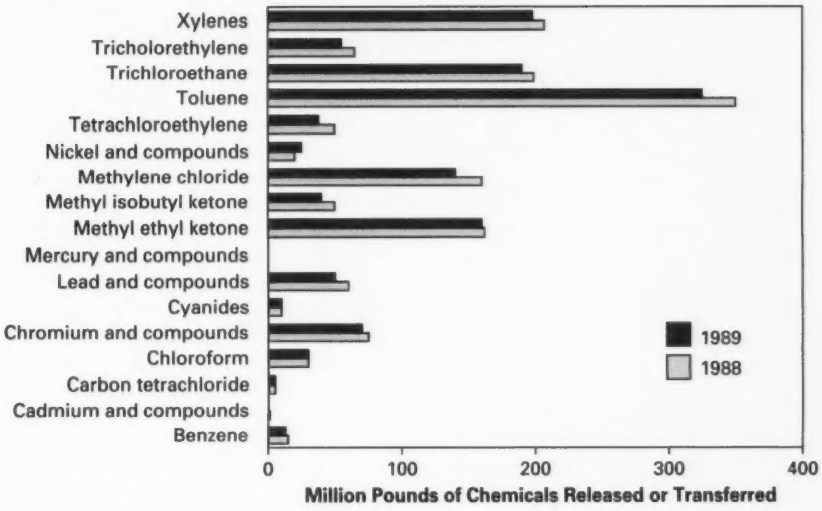
- **Prevention.** The waste management priority is to prevent or reduce pollution at the source whenever feasible.
- **Recycling.** Where pollution cannot be prevented, it should be recycled in an environmentally safe manner whenever feasible.
- **Treatment.** In the absence of feasible prevention and recycling, pollution should be treated to applicable standards prior to releases or transfers.
- **Disposal.** Only as a last resort, dispose of pollution.

All of these options are valid, and the current state of economic and environmental knowledge supports using a mix of them. Nonetheless source reduction remains the preferred approach to protecting environmental quality for a variety of reasons:

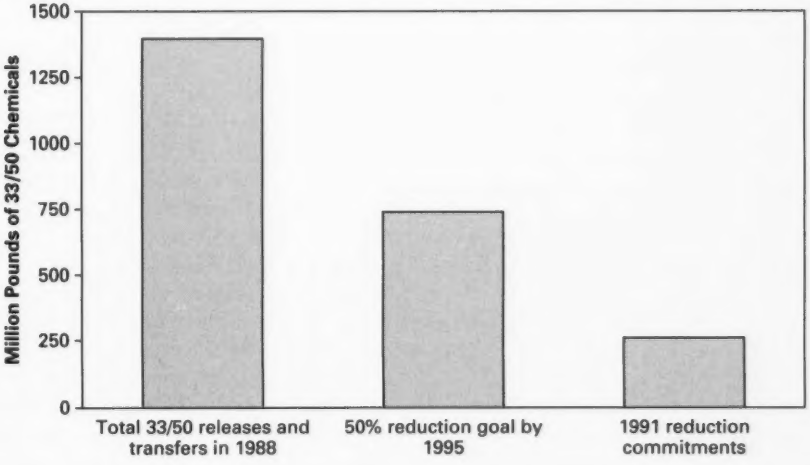
- Individual pollutant controls do not always address cross-media impacts; for example, the sludge created by treatment of air or water pollution becomes a waste disposal problem.
- Both nonpoint pollution sources, such as urban stormwater runoff, and small, dispersed point sources, such as commercial establishments, contribute a significant portion of society's harmful pollutants. However such sources are difficult to regulate through traditional large-source emission standards.
- Pollution prevention embodies efficiency in resource and energy use and therefore, in most cases, offers a more cost-effective solution in the long-run than direct regulation. This is particularly relevant at a time when economic competitiveness is a national priority and total pollution control costs to businesses and public agencies have grown to $115 billion annually.

Chemicals and reduction goals of the EPA 33/50 Program.*

33/50 chemicals in the Toxic Release Inventory.



Reduction goals of the 33/50 program.



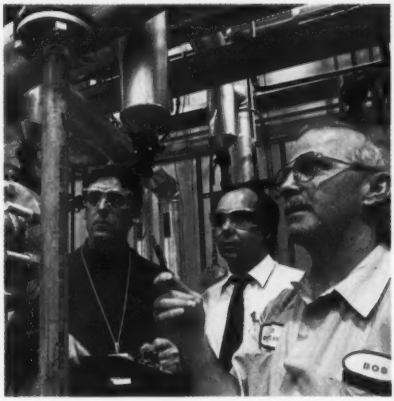
*In this voluntary program, industries commit to reduce 33 percent of targeted toxic wastes by 1992 and 50 percent by 1995.
Source: U.S. Environmental Protection Agency, *EPA's 33/50 Program: The Progress Report,* (Washington, DC: EPA, 1991).

part in the 33/50 Program. As of January 13, 1992, nearly 760 companies had committed to an average reduction of 50 percent by 1995, for a reduction of over 300 million pounds of toxic wastes.

Clean Air Act. The Clean Air Act Amendments of 1990 incorporate strategies to address serious air pollution problems, including toxic air emissions, acid rain, urban smog, and stratospheric ozone depletion. Pollution prevention is a significant goal of the amendments along with the establishment of research and technology programs at EPA. To encourage early emission reductions through pollution prevention programs, Title III allows companies that voluntarily and permanently reduce toxic air pollutants in advance of the legislated deadline the option of postponing installation of maximum available control technology.

Green Lights. This EPA program encourages voluntary installation of energy-efficient lighting technologies by the nation's private sector. Major U.S. corporations have agreed to upgrade their facilities with these technologies where profitable and to maintain or improve lighting quality. At the end of September 1991, the program had 114 corporate partners, four government partners (California, Florida, Maryland, and Oregon), and 166 allies (lighting management companies, manufacturers, and utilities). These participants have committed to use energy-efficient lighting covering a total of 1.6 billion square feet.

Geographic initiatives. Another initiative is the Great Lakes Pollution Prevention Action Plan, which aims to reduce levels of persistent toxic substances in the lakes. The Great Lakes plan includes a public/private initiative



E. Fastner, The 3M Company.

Industry is demonstrating the economic and environmental benefits of preventing pollution rather than cleaning it up.

with Chrysler, Ford, and General Motors to address persistent toxics; a cooperative effort on the part of EPA, Minnesota, Wisconsin, and Michigan focusing on Lake Superior; and pilot programs in pollution prevention for urban nonpoint sources.

Enforcement. After detecting a violation and initiating an enforcement action, EPA can use its formal negotiations and settlement process to fashion pollution prevention conditions as part of a consent order or decree. During fiscal 1991 the agency issued two policies that encourage federal negotiators to incorporate pollution prevention conditions in both single and multi-media settlements when feasible. These policies set EPA boundaries and criteria to be used when considering whether to seek and/or accept a pollution prevention activity as a basis for compliance or for reducing the size of the final penalty owed the federal government.

For example, as part of the EPA strategy to reduce lead exposures to the public—particularly the risk of high blood-lead levels in children—the Department of Justice and EPA initiated actions against several dozen facilities,

and $14 million in total penalties were recovered. In several of these cases and in individual cases under RCRA and TSCA, pollution prevention studies and emissions reductions were required by the final settlements.

Department of Defense

In July 1989 the Department of Defense (DOD) issued a Pollution Prevention Directive calling for incorporation of pollution prevention concepts on military installations. By virtue of its size and scope, DOD has the opportunity to be a major force in the national pollution prevention strategy.

TIPPP. Among DOD projects developed in 1991 was the Tidewater Interagency Pollution Prevention Program (TIPPP). The goals of TIPPP are to prevent pollution in the Chesapeake Bay and to institutionalize pollution prevention approaches throughout military installations in the area. In August 1991 DOD, EPA, the National Aeronautics and Space Administration (NASA), the Air Force, the Army, and the Navy signed a Memorandum of Understanding which formalized TIPPP. Norfolk Naval Base, Langley Air Force Base, Fort Eustis, and the NASA Langley Research Center are working with EPA to develop a multimedia pollution prevention model community. This 3- to 5-year program will use innovative waste management and source reduction techniques in all sectors from training fields to base housing, commissaries, and hospitals. After identifying processes that generate waste and consume energy, the installations will implement recycling and other projects to reduce pollution.

Source reduction. Recent DOD directives emphasize waste reduction at the source through the acquisition process and through military specifications and standards. For example, in developing the F-22, the Air Force required hazardous material management plans that avoid the use of substances such as CFCs, halons, chromium, nickel, and hydrazine. A Hazardous Materials Work Group advises the F-22 program manager and manufacturer, and the Air Force includes hazardous materials management in criteria for determining contractor award fees.

Improved material management. In 1987 DOD began requiring each of its components to pay for the disposal of its waste. Beginning in 1992 each DOD activity will pay for the disposal of its hazardous materials whose shelf-life has expired. These institutional changes provide a strong incentive for improving procedures, processes, and materials to reduce disposal costs.

Material substitution. DOD is reviewing some 40,000 military specifications and standards requiring the use of hazardous materials. The goal is to complete the review by 1993 and to change hazardous material requirements wherever possible.

Process improvements. Between 1987 and 1990, DOD reduced hazardous waste disposal by 40 percent. Using the 1987 baseline, DOD has set a target of 50 percent reduction by 1992 and another 25 percent by 1995. One project that could help accomplish these reductions is a review by Joint Logistics Commanders of non-hazardous methods for stripping paint from equipment and aircraft, including plastic media blasting, dry ice, lasers, baking soda, and even water.

NICE-3 Program

The Department of Commerce, DOE, and EPA are administering the NICE-3 program (National Industrial

Competitiveness through Efficiency: Energy, Environment, Economics). Using federal grants, the cooperative program demonstrates new technologies to prevent pollution and conserve energy. It identifies barriers to industrial pollution prevention techniques and supports the development of industrial equipment to reduce generation of high-volume wastes, to conserve energy-intensive feedstocks, and to improve industrial cost-competitiveness.

Agriculture in Concert with the Environment (ACE)

The Department of Agriculture (USDA) and EPA are taking part in a federal cross-agency cooperative grant program, ACE, to fund projects in low-input sustainable agriculture (LISA). LISA prevents pollution by limiting the use of fertilizers and pesticides. In the past year, $2 million was awarded to 21 projects involving education, demonstrations, research on wildlife and fish habitat, and studies on the economic implications of low-input sustainable agriculture.

U.S. Postal Service

In 1991 the Postal Service issued management instructions to adopt pollution prevention practices in all postal facilities. For example, recycling teams are forming at each of 38,000 post offices, stations, and branches. Evaluation criteria for projects, products, processes, and purchases now consider the environment, as the Postal Service works to maintain a quality assurance program and to instill an awareness of environmental responsibilities in employees.

Federal Trade Commission

The Federal Trade Commission (FTC) continued its involvement in the area of environmental advertising and labeling claims to prevent deception regarding environmental risks and benefits associated with various consumer products. In July 1991 FTC held formal hearings on these issues. The Commission is pursuing a number of investigations and took formal corrective action in four cases. Two actions involved aerosol spray products claiming to be "ozone-safe" and "ozone-friendly." Although these products did not contain chlorofluorocarbons (CFCs), they did contain other ozone-depleting substances. The other two actions involved degradability claims for plastic trash bags and disposable diapers. Claims that the products would break down, decompose, and return to nature in a reasonably short period of time after disposal were unsubstantiated.

FTC and EPA are coordinating activities and, with the U.S. Office of Consumer Affairs, serve on the Joint Task Force on Environmental Marketing Claims. The task force provides federal agency leadership and cooperation to reduce deceptive and misleading environmental labeling and advertising claims.

Industrial Initiatives

Among a number of industrial pollution prevention programs, the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD) joined forces with EPA in a voluntary project to develop and implement a comprehensive pollution prevention program for the dye industry. The partners developed, among other products, a guidance manual to assist companies in identifying prevention opportunities.

Private Sector Initiatives

Consult with...representatives of science, industry, agriculture, labor, conservation organizations, State and local governments and other groups...

National Environmental Policy Act, section 205(1)

Also see Pollution Prevention and related tables and figures in Part II.

Writing in the 1930s, a Wisconsin forester named Aldo Leopold claimed prophetically that government conservation efforts were "a patch but not a program." Such efforts were necessary, he said, but insufficient; they would carry the nation only "as far as the tax-string on our leg will reach." He called instead for a deeper, more widespread environmental ethic among consumers and private landowners, a proposition that is still relevant today.

Conditions and Trends

In the United States, roughly three-quarters of economic activity occurs between private parties. The majority of U.S. lands are owned by private citizens, with a large portion owned by corporations. In a nation premised on protection of private property and limited government power, efforts to preserve and enhance the environment must rely on the consent and active participation of Americans at home, at work, and at play.

In 1991 more than 1,000 nongovernment organizations (NGOs) were involved in conservation work at the local, national, and international levels, and the federal government took action to recognize and encourage private-sector environmental initiatives. A comprehensive summary of these activities is beyond the scope of this report, but a cross-section of initiatives by industry and nonprofit organizations in the United States reveals the following four themes:

Environmental quality management. A growing number of companies integrate environmental values in management decisions above and beyond what is required by law. Such companies are finding ways to address environmental concerns in a manner consistent with bottom-line performance in all aspects of business: daily management, long-range planning,

research and development, capital and operating budgets, and relationships with customers, employees, suppliers, and the public.

Partnerships. Many business people and environmental advocates are setting aside mutual distrust and hostility, traits that have often hampered progress and resulted in costly stalemates. The trend is toward cooperative approaches that offer benefits to all sides, including progress toward a cleaner, safer environment.

Innovation and new technology. The major environmental laws of the 1960s and 1970s mandated new technologies such as automobile emission control devices and wastewater treatment facilities. Today the search is on for more economical, effective technologies—hardware as well as methods—to deal with a new generation of pollution and natural resource management problems.

Education and public information. Included in nationwide efforts to raise standards of education and literacy are numerous programs to increase understanding of—and respect for—the environment.

Policies and Programs

Throughout the federal government, agencies are working to encourage private-sector initiatives to protect the environment. During the past year, the Council on Environmental Quality was especially active in this field, undertaking two major initiatives: the President's Environment and Conservation Challenge Awards and the President's Commission on Environmental Quality (PCEQ).

President's Environment and Conservation Challenge Awards

In 1991, for the first time ever, a U.S. president bestowed medals for excellence in the field of environmental conservation, just as presidents long have bestowed medals for excellence in the arts, humanities, sciences, and political-military affairs. These medals represent the nation's highest honor for environment and conservation achievement. A national competition drew 640 applications, which were judged by an independent selection committee. The committee selected 32 presidential medal and citation recipients in the categories of Environmental Quality Management, Partnership, Innovation, and Education and Communications. Brief descriptions of the presidential medal recipients follow.

Pacific Gas and Electric Company. This California electric utility is increasing the energy efficiency of its customers, developing environmentally preferred technologies, expanding the use of clean fuels, and conducting its business in an environmentally sensitive manner.

Los Angeles Times. More than 80 percent of the newsprint used to publish the *Times* contains at least 50 percent recycled fibers, making it the largest consumer of recycled newsprint in the United States. The *Times*' news coverage of local and national environmental issues has won the newspaper widespread national recognition.

The Virginia Coast Reserve. The Nature Conservancy works through partnerships with government agencies, local citizens groups, and residents to protect more than 40,000 acres in the last undeveloped chain of barrier islands on the Atlantic Coast.

Waste Reduction Task Force. Working together, two national organizations, the Environmental Defense Fund and the McDonald's Corporation, are implementing a solid waste reduction plan with 42 source reduction, reuse, recycling, and composting initiatives that may reduce the fast-food chain's waste stream up to 80 percent.

Marine Resources Council of East Florida. The Marine Resources Council (MRC) forged a partnership of local governments, businesses, and civic groups to manage the economic and environmental values of Florida's Indian River Lagoon. Through education, research, and consensus management strategies, MRC influences activities affecting this biologically diverse estuary.

American Farmland Trust. At more than 200 farms in Indiana, Illinois, Missouri, and Michigan, the American Farmland Trust is showing that reduced use of agricultural chemicals and increased use of low-cost natural resources (such as nitrogen-fixing ground covers) can yield crops and profits as great or greater than those gained from conventional farming practices.

Tufts Environmental Literacy Institute. This program, co-developed by Tufts University of Medford, Massachusetts, and Allied Signal, Inc., integrates environmental issues into undergraduate and professional school curricula. Since 1990 a total of 75 faculty members from Tufts and nine other universities, representing a variety of disciplines, have revised courses taken by thousands of students.

Environmental Media Association. A nonprofit organization based in

Wildlife Habitat Enhancement Council.

Private companies accommodate economic and environmental needs with such efforts as managing industrial lands for deer habitat.

Logo of the President's Commission on Environmental Quality.

Culver City, California, the Environmental Media Association (EMA) works with writers, producers, directors, and others to provide environmental information for use in film, television, and music. EMA has worked with more than 60 prime-time TV programs and feature films and has hosted industry-wide forums.

Project WILD. Project WILD of Boulder, Colorado, provides materials and workshops for teachers of grades K-12 with the theme, "Earth is Home To All of Us—Share It Responsibly." In less than a decade, Project WILD has provided conservation education to more than 300,000 educators and 20 million young people.

President's Commission on Environmental Quality (PCEQ)

Created in July 1991, PCEQ is a unique and innovative organization. Unlike most previous presidential commissions convened to undertake studies and recommend actions by government agencies, PCEQ will develop and promote an action agenda to improve the environment, emphasizing voluntary private-sector measures that contribute to both environmental and economic goals.

Of the 25 members serving on the President's Commission, 15 are corporate executives, 6 represent environmental and outdoors groups, and 3 come from universities and philanthropic organizations. Each member is nationally recognized as a leader for innovative efforts to improve the environment.

PCEQ met twice in 1991 and focused on four priority issue areas:

- Quality environmental management,
- Natural resource stewardship,
- International cooperation, and
- Education and communications.

Within each of these areas, committees are designing and implementing projects that will fulfill the PCEQ mission. A sampling of PCEQ projects follows.

Quality environmental management. A management project will demonstrate practical, cost-effective links between pollution prevention and total quality management at selected industrial facilities. The project will emphasize credible performance measurement, incentives for continuous improvement, and integration of environmental principles into the full range of management decisionmaking.

Energy. To accelerate investments by business and utilities in energy efficient technologies and practices, projects will illustrate that energy efficiency can save money, reduce pollution, increase productivity, and contribute to American competitiveness. A broad-based task force will provide information and assistance to businesses, nonprofit institutions, and others. Other projects being developed will promote the use of clean fuels and renewable energy sources and encourage transportation innovations.

Natural resources stewardship. A stewardship project will alert private landholders to voluntary management practices that improve stewardship of

biodiversity consistent with other land management objectives. Nearly 70 percent of lands in the continental United States, including a number of vital ecosystems, are in private hands. Another project will encourage cooperative partnerships among businesses, government, and environment and conservation groups to achieve effective solutions to environmental concerns.

International cooperation. Projects will encourage international cooperation through PCEQ support of training programs, forums that encourage partnerships among foreign governments, businesses, and non-profit groups, and information exchange about environment and development issues.

Public communications and education. A PCEQ project will communicate ways that Americans can take action in their daily lives to prevent pollution and protect both human health and the environment. The Commission will augment ongoing federal educational efforts to prevent childhood exposure to lead.

Medal and citation recipients in the President's Environment and Conservation Challenge Awards Program, 1991.

Category	Medal	Citation
Environmental Quality Management	Pacific Gas and Electric Company: Environmental Policy and Programs, San Francisco, CA	The Kroger Company—Louisville Marketing Area: Environmental Program, Louisville, KY
	The *Los Angeles Times*: Environmentally Conscious Programs, Los Angeles, CA	3M: Quality Environmental Management, St. Paul, MN
		BankAmerica Corporation: Environmental Policies, San Francisco, CA
		SC Johnson Wax: Waxdale Innovative Environmental Technology, Racine, WI
		Herman Miller, Inc.: Environmental Consciousness Policies, Zeeland, MI
Partnership	The Virginia Coast Reserve: The Nature Conservancy and partners, Washington, DC	Playa Lakes Joint Venture: Partners in Texas, Oklahoma, Colorado, Kansas, and New Mexico
	Waste Reduction Task Force: McDonald's Corporation, Oak Brook, IL, and Environmental Defense Fund, New York, NY	Wildlife Habitat Enhancement Council, Silver Spring, MD
	Marine Resources Council of East Florida, Melbourne, FL	Household Hazardous Waste Project: University of Missouri Extension, Columbia, MO, and the Environmental Improvement and Energy Resources Authority, Jefferson City, MO
		Sacramento River Project: The California Nature Conservancy and partners, San Francisco, CA
Innovation	American Farmland Trust: Sustainable Agriculture Project, Washington, DC	AT&T: Global Elimination of Ozone-Depleting CFCs, New York, NY
		Department of Food Science, North Carolina State University: Pollution Prevention in Food Processing, Raleigh, NC
		Reynolds Metals Company: Consumer Aluminum Recycling, Richmond, VA
		American Forestry Association: Global ReLeaf, Washington, DC

President's Environment and Conservation Challenge Awards, (continued).

Category	Medal	Citation
Innovation (continued)		Eaton Corporation: Dissolved Air Flotation System, Cleveland, OH
		Green Bay Packaging: Developing and Marketing Ecologically Responsible Packaging, Green Bay, WI
		The Procter & Gamble Company: Plastics Recycling with Innovation and Technology, Cincinnati, OH
		N-Viro Energy Systems: N-Viro Soil, Toledo, OH
Education and Communications	Tufts Environmental Literacy Institute: Tufts University, Medford, MA	Times Mirror Magazines: Conservation Council, Washington, DC
	Environmental Media Association, Culver City, CA	School of Natural Resources, University of Michigan: Global Rivers Environmental Education Network (GREEN), Ann Arbor, MI
	Project WILD, Boulder, CO	Center for Marine Conservation: Clean Ocean Campaign, Washington, DC
		Wildwood Girl Scouts: Adopt-a-Stream and Storm Drain Stenciling Program, Portland, OR
		Southern California Edison: Customer Technology Application Center, Irwindale, CA
		Island Press: Center for Resource Economics, Washington, DC

Source: CEQ, 1991.

The President's Commission on Environmental Quality (PCEQ).

Member	Affiliation	Location
E.L. Artzt	Procter & Gamble Company	Cincinnati, OH
M.R. Barnett	University of Houston	Houston, TX
R.P. Bechtel	Bechtel Group, Inc.	San Francisco, CA
D.L. Buntrock	Waste Management, Inc.	Oak Brook, IL
R.A. Clark	Pacific Gas and Electric Company	San Francisco, CA
D. Crandall	American Recreation Coalition	Washington, DC
M.R. Deland	Council on Environmental Quality	Washington, DC
K.T. Derr	Chevron Corporation	San Francisco, CA
R.W. Fri	Resources for the Future	Washington, DC
K.S. Fuller	World Wildlife Fund and Conservation Foundation	Washington, DC
J.A. Georges	International Paper Company	Purchase, NY
P.E. Gray	Massachusetts Institute of Technology	Cambridge, MA
G.M. Grosvenor	National Geographic Society	Washington, DC
A.F. Jacobson	3M Company	St. Paul, MN
F. Krupp	Environmental Defense Fund	New York, NY
K.L. Lay	Enron Corp.	Houston, TX
R.P. Mayer	Kraft General Foods North America	Glenview, IL
N.J. Nicholas, Jr.	Time Warner Inc.	New York, NY
P.F. Noonan	Conservation Fund	Arlington, VA
H.A. Poling	Ford Motor Company	Dearborn, MI
F. Popoff	The Dow Chemical Company	Midland, MI
W.D. Ruckelshaus	Browning-Ferris Industries, Inc.	Houston, TX
A. Simmons	John D. and Catherine T. MacArthur Foundation	Chicago, IL
P.R. Vagelos	Merck & Co., Inc.	Rahway, NJ
J.F. Welch, Jr.	General Electric Company	Fairfield, CT

Source: CEQ, 1991.

Public Lands

Preserve important historic, cultural, and natural aspects of our national heritage...

National Environmental Policy Act, section 101(b)(4)

Also see Biodiversity, Forestry, and related tables and figures in Part II.

Public lands managed by federal agencies total over half a billion acres. Through its management of these lands, the federal government is able to influence standards in natural resource conservation for the states and the private sector, which together control two-thirds of the land in the United States.

Conditions and Trends

The U.S. government manages its public lands under a policy of multiple use that includes recreation, watersheds, wilderness, fish and wildlife habitat, timber, minerals, and range. Some areas are devoted to specific uses, such as national defense. Only about one-tenth of all federal lands have protected designations such as wilderness areas, and even protected lands can provide multiple uses such as recreation and wildlife habitat.

In some areas, management decisions are moving away from multiple use and toward more restrictive use of public lands. For example, the Alaska National Interest Lands Conservation Act of 1980 resulted in the transfer of 97 million acres under the Bureau of Land Management (BLM) to the Fish and Wildlife Service (FWS) and the National Park Service (NPS). Over the past three decades, the National Wilderness Preservation System has expanded to 94 million acres largely through the designation of existing roadless areas on national forests and Department of Interior (DOI) lands, rather than by adding new lands to the federal estate. However, the government is adding new acreage to meet management objectives. For example, BLM has acquired or exchanged land to consolidate its holdings thereby increasing management efficiency.

Increasingly public land managers face conflicting demands for resource uses. To provide the natural resources needed for economic development, they apply sustainable practices to ensure resources of adequate quantity and qual-

Federal Land Management Agencies

The following federal agencies manage over 650 million acres of public lands:

Department	Agency	Land *million acres*
Interior	Bureau of Land Management	270
Agriculture	Forest Service	191
Interior	Fish and Wildlife Service	92
Interior	National Park Service	80
Defense	Army/Air Force/Navy/Marines	25

ity for future generations. Toward these goals, federal agencies coordinate efforts with states, municipalities, academia, and private landowners.

Policies and Programs

In 1991 public land managers implemented programs designed to restore and protect federal public lands for sustainable use and enjoyment.

America the Beautiful

This initiative of the Bush Administration aims to protect, preserve, and expand public lands. In 1991, as part of the initiative, DOI acquired over half a million acres of land. BLM proceeded with critical acquisitions in the San Pedro Riparian National Conservation Area in Arizona, a desert area with 33 miles of perennial stream that provides diverse wildlife habitat and excellent recreation areas. In California, the Fish and Wildlife Service joined with the state Department of Fish and Game, the state Wildlife Conservation Board, the National Fish and Wildlife Foundation, and the Nature Conservancy to acquire the Llano Seco Rancho Preserve, a 14,000-acre wetlands on the Sacramento River that provides prime wildlife and waterfowl habitat. Nationwide, during the past year, the National Park Service acquired new acreage for 38 recreation projects and provided matching funds to states for outdoor recreation. The Department of Defense (DOD) participated in the ATB initiative by restoring environmentally sensitive and marginally productive military lands.

America the Beautiful also includes the President's National Tree-Planting Initiative, an effort to plant up to one billion trees annually for at least ten years. The USDA Forest Service is participating through the Forest Stewardship Program, which assists owners of private nonindustrial forestlands in developing landowner forest stewardship plans prior to timber harvest. A Stewardship Incentive Program provides cost-sharing assistance to private landowners who plant trees on eroded lands.

The National Tree Trust, a private, nonprofit group, authorized by the 1990 Farm Bill to raise private-sector funds for tree planting, opened offices in Washington, D.C. in March 1991.

Forest Legacy

The 1990 Farm Bill also authorized the Forest Legacy Program in the Department of Agriculture to protect private forestlands threatened with conversion to nonforest uses, such as residential and commercial development. The USDA Forest Service is developing guidelines and has requested funding of $5 million to initiate the program. State Forest Stewardship Advisory Committees will work with the Forest Service to purchase conservation easements on forestlands with outstanding ecological values such as fish and wildlife habitat, riparian ecosystems, and scenic, cultural, and recreational resources. Congress called for initial programs in New York, New Hampshire, Vermont, Maine, and Washington state.

Legacy '99

In 1991 the Secretary of the Interior introduced the Legacy '99 initiative to upgrade conditions on the 442 million acres administered by DOI. The goal is to clean up hazardous materials, increase maintenance, rehabilitate facilities, and inspect the 377 dams administered by DOI, correcting unsafe conditions, all by the end of the decade. In 1991 the dam safety program recorded 217 inspections; 18 dams received corrective actions, and 35 were in the final stages of construction or corrective actions.

Legacy Resource Management

In 1991 Congress appropriated $10 million "to promote, manage, research, conserve, and restore the priceless biological, geophysical, cultural, and historical resources" on public lands administered by the Department of Defense. The Army, Air Force, Navy, and Marine Corps manage public lands at 900 installations ranging in size from 10 acres to 2 million acres. DOD has 90 demonstration projects underway to improve land stewardship while reducing the cost of environmental compliance. In a project at Vandenburg Air Force Base in California, land managers supervised the excavation of Native American human remains from a religious site threatened by erosion and vandalism. The remains will be returned to tribal groups.

Public Forestlands

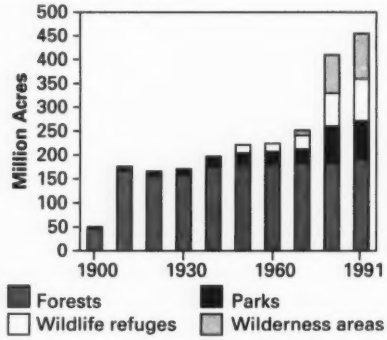
The Forest Service administers the National Forest System, encompassing 191 million acres in 156 national forests. The Multiple-Use Sustained-Yield Act of 1960 mandates a policy of multiple-use management on the national forests, and the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) and the National Forest Management Act of 1976 (NFMA) direct forest planning. DOI also applies a multiple-use concept in managing 80 million acres of public forestlands under the Federal Land Policy and Management Act of 1976 (FLPMA). State and local governments manage an additional 30 million acres of public forestlands, on which uses range from high-density recreation and timber production to wildland preservation.

Public Rangelands

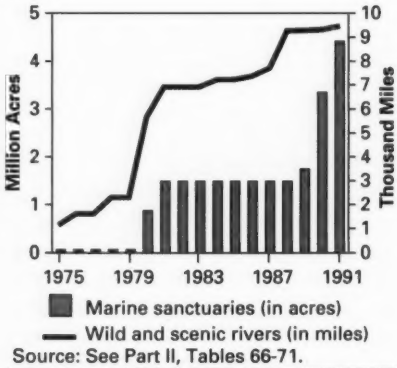
The Bureau of Land Management has adopted a long-term strategy called, "The Range of Our Vision," to improve the 170 million acres of range under its care. BLM targeted 68 million acres for ecological restoration by the year 2009, the 75th anniversary of the Taylor Grazing Act. Grazing fees, charged on a per-animal-unit-month basis (one full-grown cow for one month or its equiva-

Selected federal lands and waters.

National forests, wildlife refuges, parks, and wilderness areas.



Marine sanctuaries and wild and scenic rivers.



Source: See Part II, Tables 66-71.

lent), increased in March 1991 from $1.81 to $1.97. The federal government collected over $18 million in grazing fees in fiscal 1991. Legislation to increase these fees was the subject of debate in Congress.

The Forest Service uses a range management approach called "Change on the Range" to ensure that commodity production on the 104 million acres of range under its care is environmentally sound. The Forest Service classifies half of these acres as suitable for grazing. Many of the remaining acres contain timber as well as grassland, and timbered acres offer minimal benefits for grazing stock. In 1990 the Forest Service administered 9,840 grazing allotments on western and eastern forests and on the National Grasslands, collecting $10 million in grazing fees. In 1991 the Forest Service, BLM, and FWS cosponsored a National Livestock and Big Game Symposium with ten other organizations to address concerns related to the condition of these animals on public lands in the West.

Mineral Leases on Public Lands

The Forest Service manages 12 million acres under lease for coal, oil, gas, geothermal, and other energy resources. This acreage reflects a decrease of 14 percent from 1989 and a 65 percent decrease from 1983. Most of the acreage is leased for oil and gas exploration, with only a minor portion allocated to non-energy leasable minerals. In 1990 minerals on national forests and grasslands generated receipts of $190 million from rents, royalties, sales, and bonus bids. In addition, the DOI/Minerals Management Service manages the leasing and development of energy and mineral resources on the nation's outer continental shelf (OCS), encompassing approximately 1.4 billion acres, and including an estimated 14 percent of the nation's oil reserves, and nearly 24 percent of natural gas reserves. During the year, several bills were introduced in Congress to reform the 1872 law that governs the leasing of public lands for non-energy minerals mining.

Visibility at the Grand Canyon

The Grand Canyon, among the "crown jewels" of America's 358 units in the National Park System, is also among the parks experiencing air pollu-

tion from outside sources. In recent years, a haze over the canyon has reduced visibility, especially at times during the winter months. A major source of the haze is a large coal-fired plant 15 miles from the northern boundary of the canyon. An agreement reached between environmental groups and the owners of the Navajo Powerplant, adopted as an EPA rule in September 1991, will cut the annual sulfurous emissions from the plant by 90 percent by the end of the decade.

Refuges 2003

By means of a programmatic environmental impact statement and a 10-year management plan, the Fish and Wildlife Service is charting the course of the National Wildlife Refuge System through its centennial in the year 2003. Since 1903 the system has grown to 472 national wildlife refuges, waterfowl production areas in 166 counties, and 51 coordination areas. New ecological knowledge is expanding management emphasis to include plants and nongame animals as well as traditional game species, such as ducks.

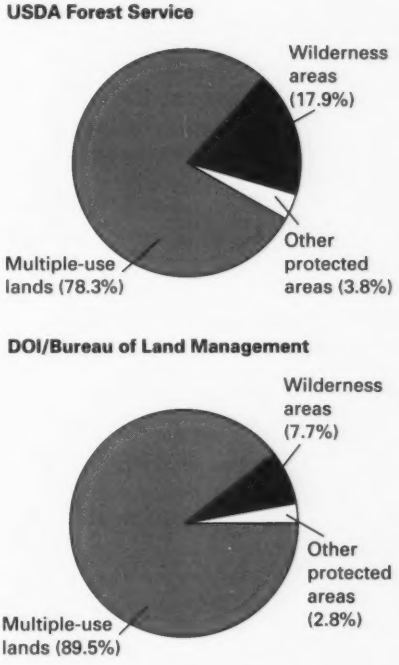
Watchable Wildlife

Federal land management agencies, including BLM, FWS, and DOD, are participating with public and private organizations in the Watchable Wildlife Program. The program provides opportunities for the public to observe native North American wildlife species in natural settings. Other sponsors include the Nature Conservancy, Defenders of Wildlife, and the National Audubon Society.

Private Concessions on Public Lands

The Secretary of the Interior organized a Concessions Management Task Force comprising DOI land-management agencies, the USDA Forest Service, and the Army Corps of Engineers. The task force is reviewing policies and recommending ways to improve the management of private concerns operating concessions on public lands, such as hotels, restaurants, and ski resorts. A draft report recommends maintaining financial consistency among agencies, increasing competition by setting appropriate fees and durations of agreements, and improving integration of concessions management into the planning process of federal agencies.

Special uses of Forest Service and Bureau of Land Management lands.



Source: See Part II, Table 73.

Partnerships and Volunteerism

DOI is promoting public-private partnerships to encourage documentation and protection of 25 Civil War battlefields. In Missouri, DOI worked with the Monnett Battle of Westport Fund, Inc., the Civil War Round Table of Kansas City, and the Association for the Preservation of Civil War Sites to add acreage to protect the site of the Battle of Byram's Ford. In Virginia, the Mellon Foundation and the Conservation Fund purchased land to protect the Five Forks Battlefield and in March 1991 deeded the site to the American people.

A DOI Enjoy America Outdoors initiative enlists partners and volunteers in cost-sharing projects related to camping, fishing, touring, bicycling, hiking, winter sports, boating, and hunting. The National Park Service, Dow Chemical Company, and Huntsman Chemical Corporation formed a partnership in 1990 to recycle plastic, glass, and aluminum in three parks—Acadia (ME), Great Smoky Mountains (TN), and Grand Canyon (AZ). The companies have invested $250,000 per park to start recycling programs. During the first summer and fall, 8 million park visitors participated, recycling 86 tons of trash. In 1991 the program expanded to include Mount Rainier (WA) and Yosemite (CA).

During the past year, BLM initiated 307 "Challenge Cost Share" projects totaling $8 million; NPS cost-sharing projects included a partnership with the Friends of Mount Rushmore, which raised $50 million to restore the national landmark; and FWS generated 232 Challenge Grant projects for a total of $6 million. In 1990 DOI enlisted the help of 90,000 volunteers in visitor centers, interpretative programs, and repair work such as trail maintenance.

The USDA Forest Service, through its National Recreation Strategy, has a cost-sharing program to recruit profit and nonprofit groups for partnerships in recreation projects, such as visitor information centers, ski areas, or one of the 25 National Recreation Areas, 70 National Wild and Scenic Rivers, 5,800 campgrounds and picnic areas, or 114,366 miles of trails on the national forests.

Wilderness

Since 1964 Congress has set aside 361 units in the National Wilderness Preservation System. DOI manages 166 wilderness units for a total of 61 million acres on lands managed by BLM, FWS, and NPS. In 1991 BLM completed nine statewide studies of potential wilderness areas in the West and submitted recommendations to the President, including support for Congressional designation of 2.3 million acres of BLM lands as wilderness.

The Forest Service manages 33.6 million acres of wilderness areas. National Forest System wilderness comprises 80 percent of wilderness in the contiguous 48 states, although DOI manages vast acreages in Alaska. In 1990, in Alaska, 322,000 acres of wilderness were set aside on the Tongass National Forest, and federal legislation designated 25,000 acres of wilderness in Illinois.

During 1990 the Forest Service recorded 11.9 million recreation-visitor-days in wilderness areas, which represent 4.5 percent of total recreation use on the national forests. The Forest Service also has recommended the addition of over 100 rivers on the national forests for the Wild and Scenic designation.

Science and Technology

[Recognize the] impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances...

National Environmental Policy Act, section 101(a)

Also see Energy, Mission to Planet Earth, Pollution Prevention, and related tables and figures in Part II.

The United States remains at the forefront of environmental science and technology, although Japan and several European nations offer strong competition. U.S. private enterprises have long been noted for innovation and, assisted by government institutions, they continue to make progress with scientific discoveries and new technologies in pollution control, pollution prevention, and natural resource management.

Conditions and Trends

In March 1991 a national panel of science and technology experts submitted a report to the President, listing 22 categories of technology considered essential for long-term national security and economic prosperity. Of these, several relate specifically to the environment: biotechnology, energy technologies, pollution minimization, remediation, and waste management. Others on the list, such as computers and software, advanced materials, and superconductors have indirect but significant consequences for the environment.

Biotechnology

Using biological knowledge to improve plants, animals, or the environment is an ancient science. One example is the selective breeding of crops and farm animals; another is fermentation, used to produce bread and alcoholic beverages. Recently evolutionary advances in biotechnology have produced a range of new plant and animal varieties as well as vaccines, nontoxic pesticides, and pollution cleanup techniques. Specially developed bacteria that break down hydrocarbons were used in the cleanup of recent oil spills in Alaska and Texas, and others are being tested in municipal wastewater treatment.

Energy

In the field of energy technology, growing global demand for electricity

and mobility, combined with concerns about related wastes and air emissions, have led to renewed efforts at home and abroad to promote cleaner, highly efficient energy technologies.

Anti-Pollution Technologies

In 1990 the United States spent $115 billion on pollution minimization, remediation, and waste management. That figure, over 2 percent of the U.S. gross national product, is growing at an annual rate of approximately 5 percent. In short the nation has a growing need for technologies that prevent or reduce the greatest risks to health and the environment at the least possible cost to society.

Policies and Programs

Federally sponsored science and technology programs support the nation's quest to assure a high quality of life and to balance environmental protection with economic prosperity. Environmental technology is rooted in the nation's basic research enterprise, which is unsurpassed in the world. In recent years, federal support of basic research has led to valuable new envi-

A World Market in Environmental Technology

Environmental technology offers opportunities for economic development and international cooperation. A world market exists in pollution cleanup and prevention, and the United States is in a position to reap economic, diplomatic, and scientific benefits from its long-term investment in environmental protection. European and Japanese industrialists are developing long-range plans to take advantage of these opportunities. The following examples indicate the magnitude of the market:

- According to estimates by the Organization for Economic and Cooperative Development and the Department of Commerce, the world market for environmental goods and services was in excess of $200 billion in 1990. The portion of that market available to all exporters was an estimated $30 billion, and the U.S. share of that export market was 10 percent or $3 billion.

- In 1990 the United States spent $115 billion on environmental cleanup. The Environmental Protection Agency estimates that, by the year 2000, the United States will spend up to $180 billion annually to clean up the environment.

- In Europe alone, the Netherlands expects to spend $100 billion for cleanup of the Rhine River over the next few decades. The Worldwatch Institute estimates that Poland will need $20 billion, Czechoslovakia $24 billion, and Germany more than $250 billion to bring pollution down to levels considered acceptable in the West.

ronmental technologies. A number of programs are designed to speed the development, commercialization, and deployment of these technologies, in both domestic and international settings.

Federal Research and Development

The Office of Science and Technology Policy (OSTP) in the Executive Office of the President works to increase the effectiveness of federally sponsored science and technology. OSTP coordinates federal research and development (R&D) through an interagency mechanism known as the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET). The Council works to produce cross-cutting, interagency research programs on critical national issues. Much of the research conducted under the auspices of FCCSET is relevant to long-term environmental protection and remediation. Some examples follow.

High Performance Computing and Communications Program (HPCC). The HPCC Program supports research and deployment of innovative high performance computer architectures, applications, and networks. Scientists are using HPCC in applications such as air pollution dispersal and transport modeling, groundwater simulation, and environmental remediation. Improvements in high performance computing will expand current understanding of the chemical and dynamic mechanisms that control ozone depletion, enabling the design of effective control strategies.

Advanced Materials and Processing Program (AMPP). The goal of the AMP Program is to improve the manufacture and performance of materials to enhance the nation's quality of life. Environmental opportunities include development of substances that can serve as substitutes for chlorofluorocarbons (CFCs), advanced sorbents to enhance removal of pollutants from combustion furnaces, processes to reuse powerplant and municipal incinerator waste, and materials that biodegrade more rapidly in landfills.

Biotechnology Research Initiative. Biotechnology research contributes to a better understanding of the environment and provides new approaches to environmental restoration and preservation. Biological approaches to pollutant cleanup, waste minimization, and pollution prevention offer great promise as economically attractive, environmentally safe techniques that can be developed and applied in the next century.

Committee on Education and Human Resources (CEHR). Working through the Environmental Protection Agency (EPA), the Department of the Interior (DOI), and other agencies, CEHR is coordinating development of environmental education activities. Efforts include a clearinghouse for environmental education materials and internships focused on the science of fish and wildlife issues.

Federal Technology Transfer

The United States is hastening the development of environmental technology by transferring innovative processes from federal laboratories to private industry. In 1986 Congress passed the Federal Technology Transfer Act (FTTA) to accelerate this process. The legislation allows federal laboratories to collaborate with private parties on research and development projects. Department of Energy (DOE) laboratories, operated by contractors, were brought within this system by legisla-

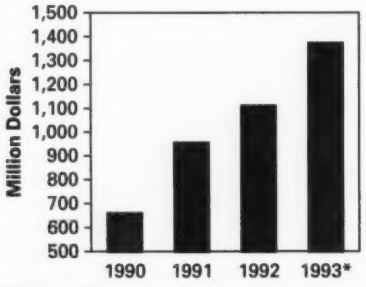
Global Change Research

The U.S. Global Change Research Program (USGCRP) is conducted under the auspices of the Federal Coordinating Council for Science, Engineering, and Technology in the Executive Office of the President. Conceived and developed to be policy-relevant, USGCRP supports the needs of the United States and other nations to address significant uncertainties in knowledge concerning the natural and human-induced changes occurring in the Earth's life-sustaining environmental envelope. Proposed federal funding of $1.37 billion in fiscal 1993 for global change research continues the growth of this, the world's largest climate research program. The U.S. research program is designed to address scientific uncertainties in the following areas:

- Climate change,
- Ozone depletion,
- Changes in terrestrial and marine productivity,
- Global water and energy cycles,
- Sea level changes,
- Impact of global changes on human health and activities, and
- Impact of anthropogenic activities on the Earth system.

Observational tools and methods developed for USGCRP are meeting various environmental needs. Advances made in remote sensing of land and oceans from satellites, aircraft, and ships enable scientists to measure environmental conditions from regional to global scales. For example, the National Aeronautics and Space Administration Mission to Planet Earth program is developing satellites and systems to monitor the planet's condition.

Federal funding for global change research.



* Proposed
Source: Executive Office of the President, Office of Management and Budget, *Budget of the U.S. Government*, (Washington, DC: U.S. Government Printing Office, 1991 and 1992).

tion in 1989. Private parties may contribute personnel, equipment, facilities, and cash to the partnership and receive rights to the intellectual property generated. The federal partner makes similar contributions and, in turn, receives royalties. As a result of FTTA, the number of cooperative R&D agreements increased from 33 in fiscal 1987 to 460 in fiscal 1990.

Federal Facilities Cleanup

DOE and the Department of Defense (DOD) are remediating contamination at many facilities. In 1990 DOE established an Office of Environmental Restoration and Waste Manage-

ment with an initial budget of $2.3 billion. In 1992 the budget will nearly double, with up to $303 million designated for research and development of innovative technologies. The 1992 budget for DOD facility cleanups is $2.76 billion. Both programs will stimulate the domestic environmental industry and, in addition, the DOE program will work with private industry to demonstrate U.S. technologies abroad as a stimulus to foreign market development.

EPA Technology Innovation Office

In March 1990 EPA established the Technology Innovation Office (TIO) to encourage the use of innovative treatment technologies by government and industry. The Office concentrates on remediation of Superfund sites, corrective action sites under the Resource Conservation and Recovery Act (RCRA), and leaking underground storage tanks. Among technologies of interest are bioremediation, thermal and physical-chemical techniques, and groundwater extraction and treatment. TIO provides information on sources of assistance and support in bringing technologies from the proof-of-concept stage to commercialization. A public database for use by cleanup professionals in identifying innovative technologies and vendors is under development.

Geographically Indexed Systems

Natural resource managers are using GIS techniques, based on computer mapping, to study the Earth's biological diversity. For example, the DOI/Fish and Wildlife Service employs GIS to map the abundance and distribution of plant and animal communities to identify areas in need of additional protection and management. The National Marine Fisheries Service uses underwater acoustic technologies, first developed for the U.S. Navy, to monitor the abundance and distribution of marine resources.

Oil Spill Cleanup

In 1991 the Minerals Management Service in the Department of the Interior opened a facility in Colts Neck, New Jersey for research into improved oil spill response capabilities. Using a 2.6 million-gallon tank, wave generators, a simulated beach, and full-scale booms and skimmer equipment, researchers can test and develop techniques for the control and cleanup of oil spills under a range of wave and weather conditions.

International Technology Cooperation

Private industry and government agencies can act individually and in collaboration to promote international technology cooperation. In contrast to the concept of "technology transfer," which implies management and financing on a centralized, bureaucratic basis, technology cooperation emphasizes the dynamic role of the private sector. Technology cooperation requires decentralized, entrepreneurial efforts to identify recipients' needs, to share information, technical know-how, and management skills, and to make investments on the basis of mutual benefit. Even as nations work toward a consensus on world environmental and developmental issues, U.S. support of technology cooperation programs will boost the domestic economy and enable poorer countries to advance their economic, social, and environmental concerns. Examples of such programs include the following:

Technology cooperation inventory. As part of U.S. preparations in

1991 for international negotiations on climate change, five federal agencies published an inventory of their technology cooperation activities related to climate change. The agencies were the Department of Agriculture, Department of Commerce (DOC), DOE, EPA, and the Agency for International Development

Export promotion. In September 1991 the DOC, DOE, EPA, and the Council on Environmental Quality cosponsored a conference on opportunities for U.S. industry to cooperate with the federal government in developing environmental technology and developing export markets abroad, particularly in Eastern Europe. Building on that effort, DOE, DOC, and EPA are working on a model program to develop other export markets. A coalition of industries, universities, and federal laboratories will identify and analyze market opportunities, with the federal government providing up to 50 percent of seed capital for promising ventures. DOC has initiated a cost-share pilot program with industry to provide investment opportunities.

EnviroTRADE. DOE is developing a computerized database, EnviroTRADE, to match existing and emerging environmental restoration technologies with worldwide needs. Users will be able to access information on the development status, funding requirements, range of applications, and availability worldwide of energy-related technologies. The database also will identify potential business opportunities and list international requests for proposals for environmental services.

Intellectual Property Rights. In the current round of negotiations on world trade rules known as the General Agreement on Tariffs and Trade (GATT), the United States seeks stronger protection against theft of intellectual property such as computer software and other new technologies. Under the existing rules, individuals and organizations in some nations may copy or steal intellectual property at no risk of prosecution, a state of affairs that deters inventors and entrepreneurs from working with those countries on the transfer of needed environmental and other technologies.

Private sector consortia. Thirteen major U.S. corporations formed the Industry Cooperative for Ozone Layer Protection in 1990. The Cooperative has initiated a computerized database, OZONET, to help industrial users of CFCs find alternatives for these ozone-depleting chemicals. OZONET is accessible from more than 750 cities in 35 countries.

Members of the President's Commission on Environmental Quality (PCEQ), named in July 1991, are nongovernment leaders working to develop an action agenda to mesh economic and environmental goals through private sector voluntary action. Among proposed PCEQ projects, one focuses on meeting the environmental technology needs of developing countries.

Transportation

Study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources...
National Environmental Policy Act, section 102(E)

Also see Air Quality, Energy, and related tables and figures in Part II.

Moving people and goods is essential to national wellbeing and competitiveness in the world marketplace. The U.S. transportation system is unrivaled and a key to the prosperity and freedom of the nation. At the same time, transportation uses energy, produces pollution, and poses the threat of accidents with major adverse impacts on human health and the environment.

Conditions and Trends

The current U.S. surface transportation system is dominated by automobiles and trucks. A Nationwide Personal Transportation Study issued by the Department of Transportation (DOT) in 1991 shows trends of increasing reliance on the automobile. In 1990 the highway share of personal travel was 88 percent, in contrast to the transit share at 2.5 percent. Vehicle miles traveled and total vehicles increased more rapidly than total population, households, and workers. Nonwork trips in 1990 made up 74 percent of all highway vehicle travel, compared to 72 percent in 1983 and 68 percent in 1969.

At the same time, demand for freight transportation continued to increase. Over 3.6 trillion ton-miles of freight are moved in the United States each year. The predominant mode for intercity freight is rail, followed by waterways, highway, pipeline, and air. Freight ton-miles have increased for all modes since 1950, but while trucking and pipelines increased in modal share, the rail share decreased.

The commercial space transportation sector is a new and growing form of commercial transportation. State and local governments have expressed interest in developing commercial spaceports, spurred by the potential of vehicles capable of flying from Earth to space and back. With these activities, the DOT Office of Commercial Space Transportation, which licenses and

U.S. Transportation System

The U.S. Transportation System is an ever-changing complex of public and private roads, airports, transit facilities, railroads, ports, waterways, and pipelines.

Components	Size		Vehicles	
Highways			(Using all highways)	
Interstates	44,700	miles	149,550,000	cars/taxis
Other principal arteries	132,000	miles	44,479,000	trucks
Minor arteries	222,000	miles	4,223,000	motorcycles
Collectors	808,000	miles	275,000	private buses
Local roads	2,674,000	miles	351,000	public buses (including school buses)
Airports				
Commercial	29	major airports	3,698	carrier aircraft
	400	primary airports	533	cargo aircraft
			1,221	commuter aircraft
General aviation (GA)	16,700	GA airports	217,200	GA aircraft
Mass Transit				
Motor bus	231,000	route miles	57,000	buses
Rail	1,321	route miles	10,200	railcars
Commuter rail	4,587	route miles	4,700	railcars
Demand-response vehicles		——	16,100	vans
Railroads				
Class I	128,000	miles	19,647	locomotives
Regional	16,000	miles	748,000	freight cars
Local	15,000	miles	500	passenger cars
Switch/terminal	4,000	miles		
Waterborne				
Ports	177	major ports	Merchant Marine:	
			709	U.S. flag ships
			Commercial fleet:	
Inland Waterways	11,700	miles	5,200	self-propelled
			32,000	nonself-propelled
Pipelines				
Gas	1,151,000	miles		
Oil	201,000	miles		

Source: U.S. Department of Transportation, *National Transportation Strategic Planning Study,* (Washington, DC: DOT, March 1990), pages 5-2, 5-3; *Status of the Nation's Highways and Bridges: Conditions and Performance,* (Washington, DC: DOT, September 1991), page 53; and *Compilation of Reports of State Authorities,* (Washington, DC: DOT, September 1991).

Growth in population and mobility.

Statistics	1969	1990	Change
	millions		*%*
Population	197.2	243.2	23
Households	62.5	93.2	49
Workers	75.8	118.3	56
Annual VMT*	775.9	1,409.2	82
Vehicles	72.5	165.2	28

*VMT=vehicle miles traveled

Source: U.S. Department of Transportation, *Preliminary Results, Personal Travel in the United States, 1990 National Personal Transportation Study,* (Washington: DOT, 1991).

supervises commercial launch activities, has assumed a greater role in assessing the impacts of these activities on the environment.

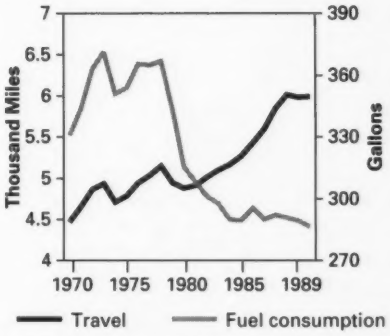
Policies and Programs

In 1990 the Department of Transportation issued a National Transportation Policy that includes environmental protection as one of six principles guiding transportation policies into the next century. Recent enactment of major legislation, such as the 1991 Surface Transportation Act, the 1990 Clean Air Act Amendments, and the Oil Pollution Act, promises to change the way that the United States moves people and goods.

Surface Transportation Legislation

On December 18, 1991, President Bush signed a $151 billion transportation bill reauthorizing federal highway construction, maintenance, and transit programs for the next six years. The act emphasizes increased flexibility for state and local governments in selecting transportation solutions and enhances state and local planning processes.

Personal vehicle travel and fuel consumption.



Source: Calculated from data in Part II, Table 1 and Table 84.

Among its key provisions are the designation of a National Highway System, the establishment of a flexible Surface Transportation Program, increased transit funding, encouragement of new technologies, and promotion of intermodal transportation. Provisions to help communities deal effectively with environmental concerns include the Congestion Mitigation and Air Quality Improvement Program, state wetlands conservation planning, and expanded eligibility for bicycle and pedestrian programs.

Air Quality

The Clean Air Act Amendments of 1990 include a combination of approaches to reduce air pollution contributed by transportation:

- Tightened standards for emissions from motor vehicles;
- Increased use of alternative-fuel vehicles;
- Requirements for states and local areas to include transportation control measures in updated plans for achieving air quality standards.

In 1991 the Environmental Protection Agency (EPA), in consultation with DOT, took the following transportation-related actions to implement the Clean Air Act Amendments:

- Updated Transportation-Air Quality Planning Guidelines;
- Provided interim guidance for determining if transportation plans, programs, and projects conform to air quality implementation plans;
- Provided guidance on transportation control measures and on calculating vehicle miles traveled for air quality plans;
- Proposed standards for urban bus emissions; and
- Proposed regulations for implementing Clean Air Act provisions relating to purchase of alternative-fuel vehicles by fleets.

Oil Pollution Prevention and Response

In 1991 the U.S. Coast Guard and EPA developed regulations to implement the Oil Pollution Act of 1990 (OPA). This law strengthens the authority of the federal government to prevent oil spills in marine and freshwater environments. It provides for the cleanup of spills and compensation for public and private damages, without preempting states' rights of recovery.

OPA requires that new tankers operating in U.S. waters be constructed with double hulls and that existing single-hull vessels be phased out. In December 1990 the Coast Guard issued a proposed rule providing guidance on double-hull construction in tank vessels. Following the release of a study by the National Academy of Sciences on alternative tank vessel design, the Coast Guard has participated in efforts by the International Maritime Organization to evaluate alternatives to double-hull construction.

Other OPA provisions for which the Coast Guard is developing guidelines and regulations include manning standards, crew-licensing procedures, vessel-design requirements, and navigation systems.

To better respond to oil spills, the Coast Guard is procuring specialized equipment and maintaining it at 19 selected sites. Proposed regulations require tank vessels, facilities, and local areas to develop oil spill response plans as well. EPA is developing regulations for oil spill contingency plans for inland waters. The agency is also developing regulations to prevent spills and accidents from tank farms, pipelines, and other oil facilities located inland.

The Oil Pollution Act established an oil spill cleanup trust fund of up to $1 billion, financed by a 5-cent per barrel fee on domestic and imported oil. The Act places liability on a responsible party for removal cost and damages for each pollution incident and establishes limits on such liability. OPA also amends the Clean Water Act to strengthen civil and criminal enforcement provisions.

International Treaties

In 1991 the United States ratified several international conventions related to marine transportation safety. For a discussion of these conventions, see the International Issues section of this report.

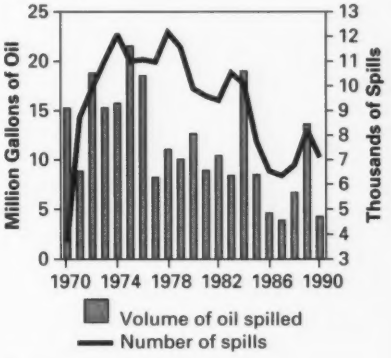
Pipeline Safety

The DOT pipeline safety program aims to prevent pipeline spills through regulations, inspection, enforcement, research, training, and information collection and dissemination. Although the historic focus of the program has been on protection of persons and property, environmental concerns are growing in importance, especially for pipelines that carry crude oil and petroleum products. The Bush Administration's proposed pipeline safety reauthorization legislation would add environmental protection as a mission of the program. Other recent initiatives include rulemakings concerning pipeline testing and inspection; a regulation to bring low pressure pipelines under pipeline safety rules; and a study on the feasibility of using instrumented internal inspection devices ("pigs") in pipelines that are located in environmentally sensitive and highly populated areas. In April 1991 DOT submitted a study to Congress on the feasibility of requiring flow-restriction devices to cut flow in case of a pipeline break.

Aircraft Noise

The Airport Noise and Capacity Act of 1990 sets national aviation noise policy and provides for a transition to a quieter aircraft fleet. The Act directs DOT to issue rules phasing out noisier Stage 2 aircraft over 75,000 pounds by December 31, 1999, using an interim compliance schedule. In 1991 the DOT Federal Aviation Administration issued final regulations on transition and other requirements of the Act.

Oil spills in and around U.S. waters.



Source: See Part II, Table 93.

Wetlands Protection

In 1991 DOT took part in developing the President's plan to slow and eventually stop the net loss of wetlands. For example, the Federal Highway Administration launched research on techniques to restore and create wetlands. The 1991 Surface Transportation Act included a provision clarifying ways that federal-aid highway funds may support state wetlands conservation planning and banking programs. The Act also provided for fuller financial support for mitigation of impacts to privately owned wetlands that are directly affected by federal-aid highway projects.

Hazardous Materials Transportation

The Hazardous Materials Transportation Uniform Safety Act of 1990 (HMTUSA) gave DOT major new responsibilities for assuring the safe transportation of hazardous materials.

The Act provides emergency response planning and training grants to personnel and employees of shippers and carriers. HMTUSA imposes standards for use by states and Native American tribes in setting and enforcing hazardous materials transportation routes. In addition to these standards, DOT developed the following regulations to implement HMTUSA provisions:

- A proposed rule to establish a national registration program for certain shippers, carriers, and packagers of hazardous materials to provide data valuable in planning emergency response to hazardous materials accidents;
- A proposed rule establishing procedures for granting safety permits to carriers hauling extremely hazardous materials; and
- A regulation, based on United Nations recommendations on packaging, providing performance-oriented standards to encourage innovation and facilitate international commerce.

In addition to HMTUSA, DOT is developing regulations to implement the Sanitary Food Transportation Act. This Act adds further requirements regarding the transportation of food, food additives, drugs, medical devices, and cosmetics in vehicles that are also used to transport nonfood products and hazardous materials.

Research and Development

The National Transportation Policy promotes advanced technologies to meet future transportation needs compatible with a cleaner and safer environment. Current DOT research initiatives include the following:

- Research supporting magnetic levitation and high speed rail technologies;
- A demonstration program funded by the Federal Transit Administration to help local transit agencies purchase and evaluate alternative-fuel buses;
- A DOT-EPA grant to the National Association of Regional Councils to integrate transportation and air quality planning;
- Research on relationships among transportation improvements, demand management, and land use;
- Development of improved techniques for oil spill response and prevention;
- Efforts to promote safe bicycling and walking;
- Research on techniques to minimize environmental impacts of transportation construction;
- Research and demonstration projects aimed at making more efficient use of the existing surface transportation infrastructure;
- Investigation of advanced Intelligent Vehicle/Highway Systems that may reduce congestion and air pollution and improve safety; and
- A DOT-sponsored research project with the National Academy of Sciences to determine levels of fuel economy that are practical and achievable over the next decade.

Water

Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings...
National Environmental Policy Act, section 101(b)(2)

Also see Agriculture, Coasts and Oceans, Wetlands, and related tables and figures in Part II.

Most regions of the United States are blessed with abundant water supplies, while others have learned ways to cope with water scarcity. The nation has invested heavily and successfully in water quality improvements since the 1960s, when many rivers and lakes were virtually open sewers. Despite these favorable circumstances, the vital role of water in natural systems and human activity leads to continuing concerns about water quality and quantity. Pending Congressional action to reauthorize the federal Clean Water Act will generate further debate in the months and years ahead.

Conditions and Trends

Water-related issues tend to fall into two categories: water quantity and water quality.

Water Quantity

Despite major droughts and water scarcity in some areas, the nation is not

Current Water Issues

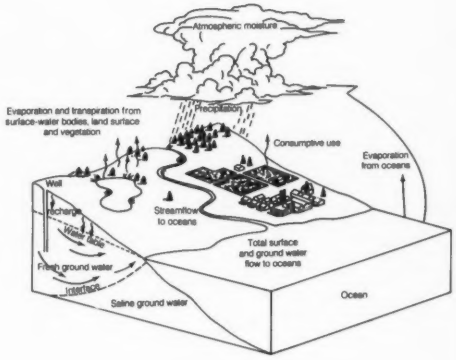
Various regions of the United States are dealing with the following water issues:

- **Increasing competition for water supplies;**
- **Vulnerability of surface water and shallow groundwater to drought;**
- **Declining groundwater levels associated with increased use;**
- **Surface water pollution, especially from nonpoint sources of pollution, such as agricultural and urban runoff; and**
- **Groundwater contamination from existing sources of pollution, such as underground storage tanks, septic systems, municipal landfills, agricultural activities, and abandoned hazardous waste sites.**

running out of water. The renewable water supply of the conterminous United States amounts to about 1,380 billion gallons per day. Total offstream withdrawals of surface water more than doubled between 1950 and 1980, but withdrawals remained less than 21 percent of the renewable supply in 1980.

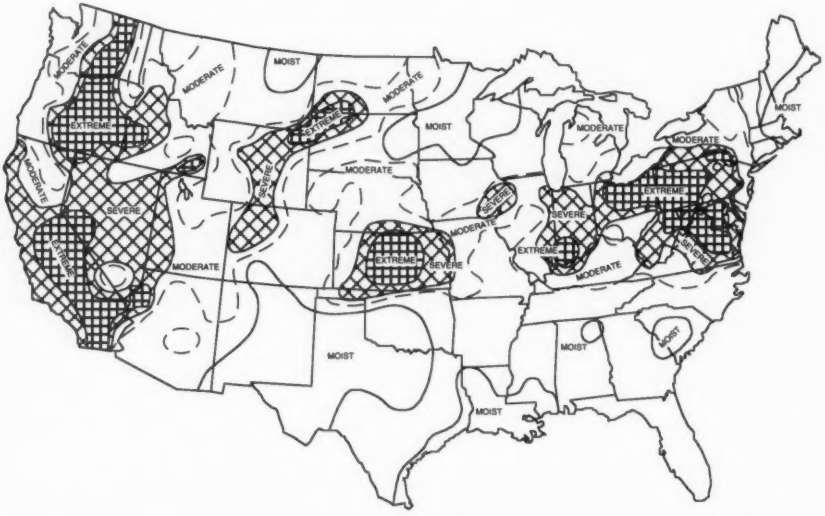
Unusually long, dry periods, or droughts, can reduce stream flow and lower groundwater tables. The severity of a drought depends upon the amount of water storage available from the preceding year, the water demands relative to average flow, and the natural flow during the drought period. Some economists suggest, however, that water scarcity could be best addressed by pricing reform to eliminate subsidies and allocate water supplies according to market signals.

Hydrological cycle.



Source: Council on Environmental Quality, *Environmental Trends,* (Washington, DC: CEQ, 1989), page 21.

Drought-severity index map, September 1991.



Note: The Palmer drought-severity index depicts prolonged abnormal dryness or wetness over months or years. The index responds slowly, changes little from week to week, and reflects long-term moisture runoff, recharge, and deep percolation, as well as evapotranspiration.
Source: U.S. Department of Commerce NOAA/U.S. Department of Agriculture Joint Agricultural Weather Facility, September 1991.

In the Great Plains and the Southwest, additional water consumption may be constrained by limited availability. Between 1980 and 1985, offstream water use in these regions decreased for the first time, led by declining agricultural and industrial withdrawals.

Water Quality

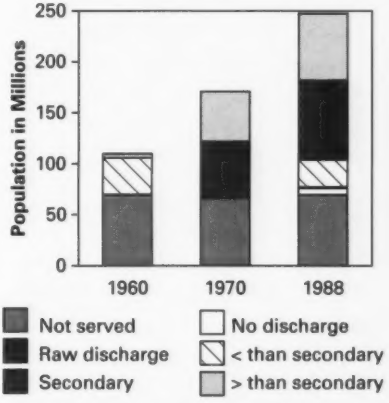
Limited data on U.S. water quality conditions preclude assessing an overall national water quality trend. The best information available indicates that water quality has improved markedly in some sites and declined in others.

In a 1990 state assessment, 70 percent of the rivers and 60 percent of the lakes assessed met water quality standards and supported such uses as fishing and swimming. Agricultural sources are the leading cause of water quality impairment, contributing to 60 percent of impaired stream miles and 57 percent of impaired lake acres. By comparison, other sources contributing to stream impairments are sewage treatment plants (16 percent of impaired miles), hydrologic/habitat modification (15 percent), resource extraction (14 percent), and storm sewers/runoff (11 percent). The leading contributors to lake impairments, after agriculture, are hydrologic/habitat modification (40 percent), storm sewers/runoff (28 percent), land disposal (24 percent), and sewage treatment plants (17 percent). These percentages are not additive because more than one source can contribute to impairment.

While concentrations of some conventional pollutants are declining, others are increasing Between the mid-1970s and mid-1980s, U.S. Geological Survey (USGS) monitoring stations recorded improvements for dissolved oxygen deficit, fecal bacteria, and phosphorus, all of which are attributable to improved wastewater treatment. The same network, however, recorded higher readings for nitrogen, chloride, and dissolved solids, which appear to be due to increased fertilizer applications, use of salt on highways, and other nonpoint sources. Increasing efforts to control nonpoint source pollution from agricultural and urban runoff should reduce these contaminants.

Sewage and Industrial Treatment. Over the past two decades, the nation has invested more than $75 billion in federal, state, and local funds to construct municipal sewage treatment facilities; the private sector has spent additional billions to limit its own discharges of conventional pollutants. The results are impressive. For example, between 1972 and 1988, the number of people served by sewage treatment plants with secondary treatment or better increased 69 percent from 85 million to 144 million. Between 1972 and 1982, municipal loads of biochemical oxygen-demand-

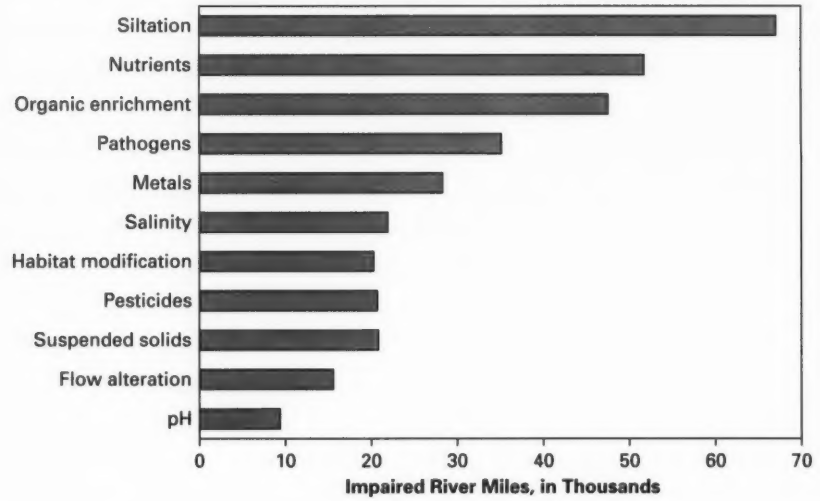
Population served by wastewater treatment systems.



Source: Council on Environmental Quality, *Environmental Quality: Twenty-first Annual Report of the Council on Environmental Quality*, (Washington, DC: CEQ, 1990), Table 31, page 309.

Pollution in U.S. rivers.

Types



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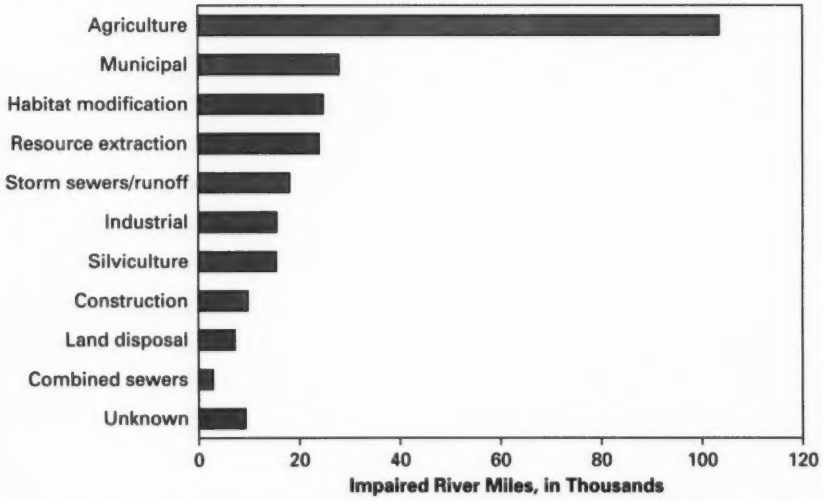
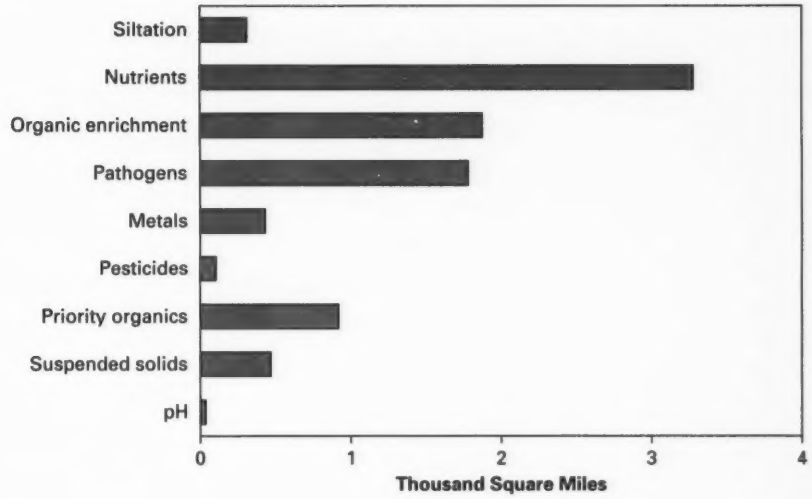


Note: Based on river miles monitored in 1990, which represent 9.5 percent of total U.S. river miles.
Source: U.S. Environmental Protection Agency, *National Water Quality Inventory: 1990 Report to Congress,* (Washington, DC: EPA, 1992).

Pollution in U.S. estuaries.

Types



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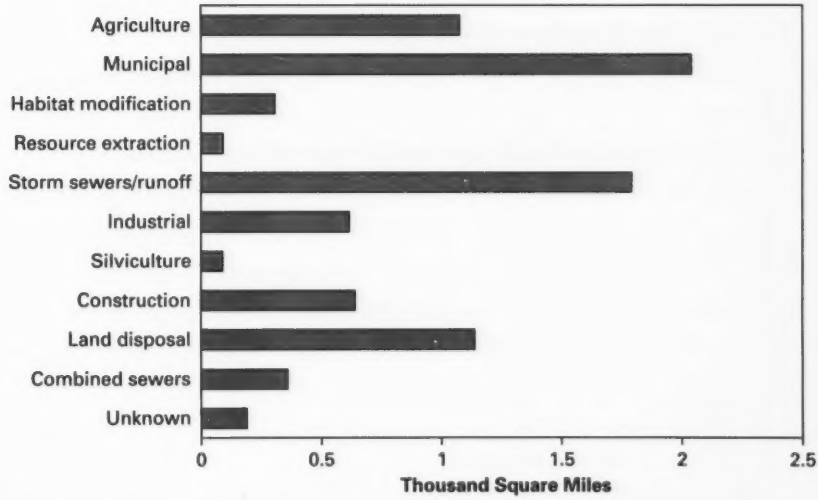


Note: Based on square miles of estuaries monitored in 1990, which represent 16.7 percent of total U.S. estuaries. An estuary is a tidal body of water, formed where a river meets the sea. Estuaries, such as bays, have a measurable quantity of salt.
Source: U.S. Environmental Protection Agency, *National Water Quality Inventory: 1990 Report to Congress,* (Washington, DC: EPA, 1992).

ing substances decreased by an estimated 46 percent and industrial loads fell by at least 71 percent.

Groundwater. Contamination of groundwater may result from underground storage tanks, septic systems, municipal landfills, agricultural activities, and abandoned hazardous waste sites. Instances of contamination can affect human health and economic development in communities where groundwater is used for drinking water. Once groundwater is contaminated, even with low concentrations of pollutants, it can be extremely expensive and technically difficult, if not impossible, to clean up on-site. Because groundwater provides about 40 percent of the average annual streamflow in the United States, the potential for adverse impacts on surface water quality and related ecosystems may also be significant, especially during periods when dilution is minimal.

Drinking Water Contaminants

According to the World Health Organization, the quality of U.S. drinking water ranks among the best in the world. Although waterborne diseases, such as cholera and typhoid fever, have been virtually eliminated in the United States, the following contaminants pose a potential risk to human health and are the focus of Environmental Protection Agency programs:

- **Lead.** Millions of people are exposed to lead in drinking water, a contaminant that poses risks to the central and peripheral nervous system, especially in small children.
- **Microbes.** Each year in the United States, an estimated 90,000 cases of potentially avoidable cases of waterborne disease occur from the use of contaminated surface water for drinking water supplies.
- **Nitrate.** This contaminant, which has adverse health effects and which is attributable to man-made and natural sources, was recently found at detectable levels in 50 percent of the nation's wells, with as many as 2 million people exposed to levels above the drinking water standard.
- **Radon.** Although 80 percent of exposures to radon, a human carcinogen, are from non-drinking water sources, the pollutant may exceed proposed standards in the drinking water supplied by 26,000 groundwater systems.
- **Disinfection Byproducts.** Millions of people are exposed to the byproducts of disinfection in drinking water, at levels that could pose a public health concern.

While a recent nationwide survey of drinking water wells found that 10 percent of community water system wells and 4 percent of private domestic wells have detectable residues of at least one pesticide, less than 1 percent were determined to have residues above levels of health concern.

Policies and Programs

Several federal agencies have water-related duties. USGS in the Department of the Interior (DOI) provides the hydrologic information needed for the management of the nation's water resources. USGS conducts hydrologic investigations in cooperation with over 1,000 state and local agencies to provide a continuing description of the U.S. water situation, and it publishes National Water Summary reports, technical reports and papers, and water maps. The Environmental Protection Agency (EPA) administers water pollution control programs, with assistance from the Army Corps of Engineers regarding a number of issues such as wetlands; and several DOI bureaus conduct water quality programs.

Water Supply and Management

Although the federal government owns a significant portion of the nation's water storage and conveyance facilities, water allocation and management responsibilities rest principally with the states. In 1988 DOI issued a policy statement recognizing that federal water transfers among willing buyers and sellers, made in accord with state law, constitute an innovative way to facilitate changes in demand for western water supplies. The DOI/Bureau of Reclamation issued guidelines to facilitate such trades, consistent with various legal and regulatory requirements, providing maximum flexibility to state, local, and tribal entities to arrive at mutually agreeable water resource solutions.

In another policy trend, some states are moving rapidly toward a more fully integrated, whole basin approach to water management. For example, under the state of North Carolina's National Pollutant Discharge Elimination System (NPDES, established under the federal Clean Water Act), permitting, monitoring, and enforcement activities are being coordinated with watershed quantity limits for each of the state's 17 watersheds. Permitting is being rescheduled so that renewals within a single watershed occur simultaneously every five-years. Ohio is pursuing a similar approach to its water management programs. In both cases, the goal is to realize greater consistency and resource efficiency while protecting the quality and intended uses of the states' waters.

Glen Canyon Dam. The DOI/Bureau of Reclamation has issued on an interim basis its operating rules for the Glen Canyon Dam, the first dam upriver from the Grand Canyon. The agency curtailed rapid changes in flow past the dam in response to evidence of environmental damage in the Grand Canyon. An environmental impact statement is expected in 1993 on permanent alternative flow options which would be more protective of the environment, and a decision on final operating rules will follow.

Research and Assessment

In cooperation with other federal agencies which have mission-related water research projects, DOI bureaus conduct the following national assessments.

National Water Quality Assessment Program. NAWQA describes the status and trends in the quality of the nation's surface waters and groundwater. In 1991 USGS began a 4-year transition from the pilot NAWQA program to a full-scale program. Investigations of hydrologic systems focus on 60 study units that range in size from 1,200 to 60,000 square miles and represent

most major river basins and aquifer systems. The program will assess 70 percent of the nation's water use and population served by public water supplies, addressing such topics as pesticides, nutrients, and sediments. Each study unit has a liaison committee with representatives from federal, state, and local agencies, universities, and the private sector. Committees for the first 20 study units began to meet in 1991.

Biomonitoring of Environmental Status and Trends (BEST). The DOI Fish and Wildlife Service (FWS) is revising and expanding its 25-year old National Contaminant Biomonitoring Program which assesses contaminant impacts on ecosystems. BEST will be coordinated with related state programs and other federal monitoring efforts such as the EPA Environmental Monitoring and Assessment Program (EMAP), the National Oceanic and Atmospheric Administration Status and Trends Program, and USGS NAWQA Program. State-of-the-art bioassessment methods and a national database will enable FWS to identify contaminant problems in a more timely fashion.

Water Quality Improvement

The goals of the Federal Water Pollution Control Act of 1972, known commonly as the Clean Water Act (CWA), are highly ambitious, including fishable, swimmable rivers throughout the nation and zero discharge of pollutants into U.S. waters. In the short term, the act provides for grants to help communities build sewage treatment plants, and it requires all municipal sewage and industrial wastewater to be treated before being discharged into waterways.

Under the act, EPA is required, in cooperation with the states, to establish limits on the amounts of specific pollutants that may be discharged by municipal sewage treatment plants and industrial facilities, based on available technologies and economic costs of compliance. Through the National Pollutant Discharge Elimination System, EPA issues permits establishing the effluent limits for all municipal and industrial dischargers. In addition to these technology-based limits, EPA may develop limits based on water quality criteria in cases where technology-based controls are not stringent enough to make waters safe for state-designated uses such as fishing, swimming, and drinking.

For industrial dischargers, EPA has established stringent standards applicable to specific industries to control up to 126 toxic pollutants. About 50 industries now face these standards, which are based on the best available technology that is economically achievable.

A number of EPA and DOI programs authorized under CWA and other statutes address freshwater and drinking water concerns. For discussion of estuarine and coastal water quality programs, see the Coasts and Oceans section.

Toxic pollutants. Among EPA pollution control programs which concentrate on water toxics are the following:

- **National Technology-Based Discharge Limits.** In 1991 EPA began development of new or revised discharge limits for nine high-risk industrial categories. EPA and the states also are incorporating water-quality based controls for toxics into permits. To date, 10,000 permits include water-quality controls for toxics.
- **National Pretreatment Enforcement Initiative.** The Clean Water Act requires certain publicly owned treatment works (POTWs) to

University of Michigan, Global Rivers Environmental Education Network.

Environmental science students learn techniques for collecting and analyzing data on water quality.

develop local pretreatment programs to control the pollutants discharged by industries into sanitary sewers. In May 1991 EPA and several states initiated pretreatment enforcement actions against 69 POTWs and 186 industrial users for failure to comply with this requirement. Penalties of $25 million have been obtained or are being sought under the enforcement initiative.

- **Lead and copper in drinking water.** In 1991 EPA issued a new regulation to control lead and copper in drinking water based on a standard that is ten times more protective than the previous standard. The regulation targets high-risk homes for protection and is expected to reduce drinking water lead exposure for 138 million people.

Combined Sewer Overflow Initiative. Combined sewer overflows (CSOs) occur where sanitary and storm sewers are interconnected. During rainstorms, these systems become overloaded, bypass treatment works, and discharge as much as 90 percent of the pollutants they contain. These untreated wastes often contain high levels of suspended solids, floatables, heavy metals, nutrients, bacteria, and other wastes. In the United States, approximately 1,200 combined sewer systems serve about 43 million people.

In 1991 EPA launched an initiative targeting those CSO systems causing the most severe water quality problems. EPA will issue new or revised permits to CSO systems lacking or having inadequate discharge permits, and plans enforcement actions against systems in violation of permit limits.

Control of stormwater discharges. Pollutants from many sources carried in stormwater discharges are largely uncontrolled and a remaining cause of impairment in some U.S. waters. In 1990 EPA issued regulations for permits to control all stormwater discharges associated with industrial activity and municipal storm sewer sys-

tems serving populations of 100,000 or more. EPA also proposed a risk-based strategy for permitting industrial stormwater discharges.

Protecting groundwater. In July 1991 EPA issued a strategy to develop state groundwater protection programs that rely on risk-based geographic targeting. Because of the costs and difficulty of cleaning up groundwater contamination, the strategy emphasizes pollution prevention for waters currently used or reasonably expected to be used for drinking water. The only other alternative is treatment at the pumping station or at the point of use.

Underground injection. In 1991 EPA negotiated unprecedented national administrative orders under the Safe Drinking Water Act requiring ten major oil companies to discontinue underground injection of waste into 1,800 wells connected to service stations. Immediate environmental benefits will accrue from ceasing waste injection and avoiding further contamination of soil and groundwater. As part of the agreement, each company agreed to implement waste minimization and pollution prevention practices.

Mexican Border Initiative. As part of an overall bilateral program addressing environmental challenges, the United States and Mexico are working to address serious problems along the Mexican border, where wastewater is frequently untreated or inadequately treated, and polluted water often becomes a source of drinking water for local communities. In 1991 EPA took part in the planning and funding of border water projects, and the state of Texas committed support for programs that address the problems of unincorporated areas, called "colonias," along the border.

National Irrigation Water Quality Program. DOI began the National Irrigation Water Quality Program in 1986, which aims to identify, evaluate, and respond to any significant irrigation drainage contamination in the Western states. Stimulated initially by concern about waterfowl that were contaminated by trace elements at Kesterson Reservoir in California's San Joaquin Valley, the program now covers DOI irrigation projects, National Wildlife Refuges, and migratory bird and endangered species areas that receive water from irrigation projects. During reconnaissance investigations, waterfowl deformities or reproductive problems have been found at five locations.

During 1991 reconnaissance investigations for another five areas were published. In addition, one reconnaissance investigation was started, and four others moved into their second year. In 1991 detailed studies were underway for three areas, and planning for remediation had begun in four areas: the Middle Green River Area in Utah, the Kendrick Reclamation Project Area in Wyoming, the Stillwater Wildlife Management Area in Nevada, and the Salton Sea Area in California.

Wetlands

Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations...
National Environmental Policy Act, section 101(b)(1)

Also see Agriculture, Coasts and Oceans, and related tables and figures in Part II.

Over the past decade, concern about the destruction of wetlands has motivated federal efforts to slow the loss of these ecologically valuable ecosystems. While more sophisticated scientific data will assist such efforts, the nation is making progress in identifying and protecting both coastal and freshwater wetlands.

Conditions and Trends

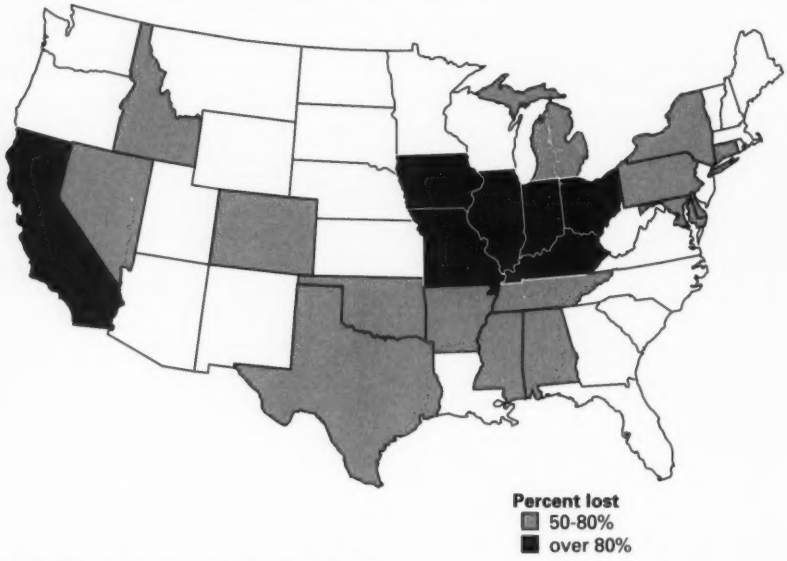
Wetlands are diverse ecosystems that provide ecological benefits by supporting commercial fisheries, controlling floods, filtering wastes from water, and serving as recreation areas. They also provide habitat for many plant and animal species, including economically valuable waterfowl and one-third of the nation's endangered species.

Three-quarters of the remaining wetlands in the lower 48 states are privately owned, and the pressure to develop them often conflicts with the nation's conservation goals. A sound, long-term, national policy requires a harmonization of interests.

More than half the nation's wetlands have been lost since the eighteenth century, with seven states losing more than 80 percent of their original wetlands. From the mid-1950s to the mid-1970s, wetlands in the lower 48 states were converted at the rate of 458,000 acres per year. Estimates in 1991 by the Department of the Interior, Fish and Wildlife Service suggest the loss rate from the mid-1970s to the mid-1980s for the continental United States has slowed by 37 percent, to approximately 290,000 acres or 453 square miles per year.

Recent evidence indicates a slowing of wetlands losses in agricultural regions, which cover three-quarters of the continental U.S. land mass. Estimates by the Department of Agriculture, Soil Conservation Service covering non-federal rural lands in the continental United States indicate that wetlands losses during 1982-1991 were approximately 120,000 acres per year,

States with wetlands losses of over 50 percent.



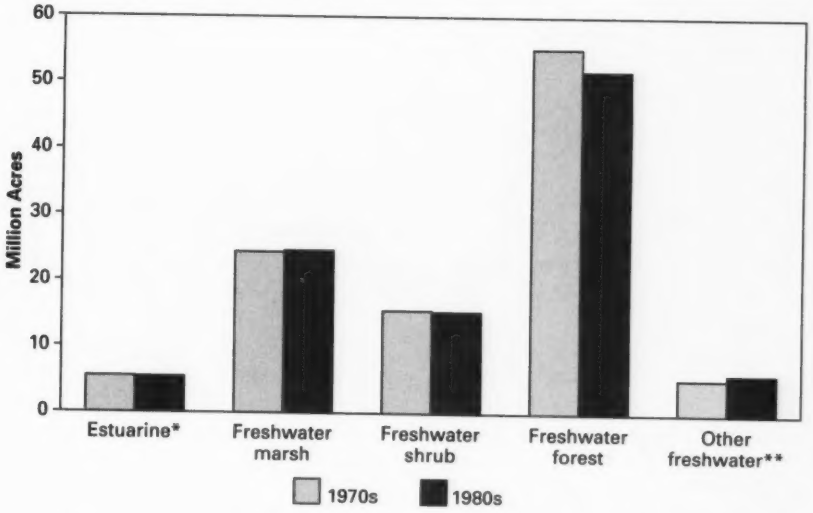
Note: Data is from 1780s through mid-1980s.
Source: U.S. Department of the Interior, Fish and Wildlife Service, *Wetlands: Status and Trends in the Conterminous United States, Mid-1970s to Mid-1980s,* Washington, DC: FWS, 1991), page 2.

nearly 40,000 acres per year less than during 1974-1983. Reduced wetlands conversions in rural areas are attributable to the agricultural recession in the early 1980s, which made conversions less profitable, and to the enactment of Swampbuster provisions in the 1985 and 1990 Farm Bills.

Roughly 170 million acres of wetlands exist in Alaska. Many of these areas are publicly owned, although precise figures are not available. Total wetlands losses in Alaska have been less than 1 percent, although in coastal areas losses have been much higher. Areas around major cities such as Anchorage and Juneau have lost up to 50 percent of their coastal marine wetlands to development.

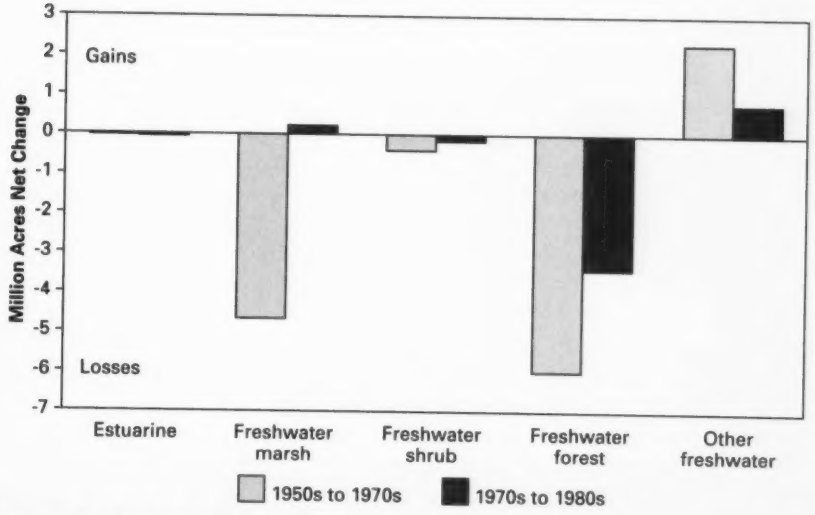
Coastal wetlands provide spawning grounds for commercial fisheries, water quality benefits, storm surge protection, and recreation areas. In 1991 the National Oceanic and Atmospheric Administration (NOAA) published new data on the distribution of coastal wetlands, defined as those within drainage areas directly surrounding estuarine waters or within counties adjacent to marine waters (excluding Alaska and Hawaii). The report concluded that 63 percent of coastal wetlands are forested and scrub-shrub areas—categories about which little is known—while well-studied habitats such as salt marshes and tidal flats constitute only 16 percent and 4 percent, respectively. NOAA estimated that coastal wetlands make up 16 percent of the nation's coastline and account for nearly 30 percent of U.S. wetlands. While precise loss figures are not available, conversions appear to be greatest in the Mississippi River delta.

U.S. wetlands distribution, by type.



* Includes unconsolidated shore, rocky shore, aquatic bed, forested, shrub, and intertidal emergent wetlands—brackish and saltwater.
** Includes freshwater shores, beaches, bars, open water, ponds, and floating aquatic or submerged vegetation.
Source: See Part II, Table 63.

U.S. wetlands gains and losses, by type.



Source: See Part II, Table 63.

Policies and Programs

In 1991 the U.S. government made numerous efforts to reform federal wetlands programs.

No Net Loss of Wetlands Comprehensive Proposal

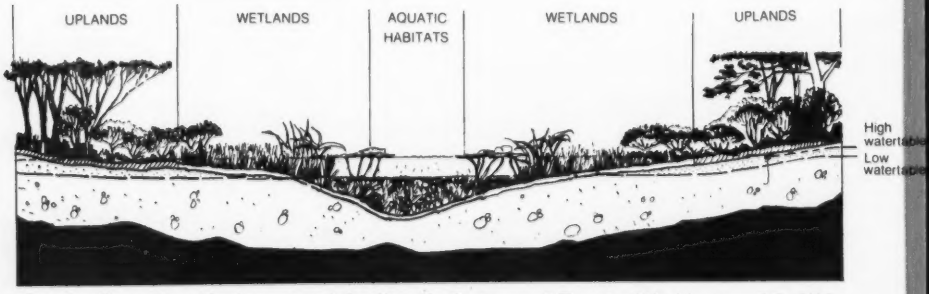
To achieve his national goal of "no net loss" of wetlands, President Bush in August 1991 offered a comprehensive policy proposal, which includes the following provisions:

Nonregulatory programs. While federal regulatory programs under section 404 of the Clean Water Act and the Swampbuster provisions of the Farm Bill are the best-known programs offering protection to wetlands, the President proposed the following actions to strengthen nonregulatory efforts:

- Full funding for the Wetlands Reserve Program authorized by the 1990 Farm Bill, providing nearly $800 million during 1993-1995 to encourage farmers to remove up to 1 million acres of wetlands from production through voluntary easements;
- Full funding for the North American Waterfowl Management Plan to restore declining migratory bird populations through acquisition, restoration, and enhancement of wetlands in Canada, Mexico, and the United States;
- Initiating a wetlands restoration and creation program on federal lands;
- Making acquisition of wetlands a priority in the allocation of funds to states under the Land and Water Conservation Fund;
- Using the best mapping and information management technology to assess national wetlands trends and expanding wetlands research;
- Increasing public outreach and education concerning federal wetlands programs; and
- Revising Executive Order 11990 (1977) to include a commitment to the no net loss goal and an increased emphasis on stewardship of wetlands on federal lands.

Revising the Federal Delineation Manual. In January 1989 four federal agencies—the Environmental Protection Agency, the Army Corps of Engineers, the DOI/Fish and Wildlife Service, and the USDA/Soil Conservation Service—issued a joint manual to define what constitutes a wetlands area for purposes of federal regulation. The manual redressed inconsistencies

Identifying features of wetlands.



Source: Council on Environmental Quality, *Environmental Trends,* (Washington, DC: CEQ, 1989), page 97.

No Net Loss of Wetlands

President Bush's national goal of "no net loss" of wetlands has been a common reference point for government efforts to reform federal wetlands regulations. In August 1991 the President proposed a three-part plan to move toward his no net loss goal.

- **Acquisition and enhanced protection.** The Administration is promoting the Wetlands Reserve Program and the North American Waterfowl Management Plan as well as other major efforts to protect wetlands.

- **Delineation manual.** In 1991 the Environmental Protection Agency, the Army Corps of Engineers, the DOI/Fish and Wildlife Service, and the USDA/Soil Conservation Service proposed revisions to the federal manual for identifying and delineating wetlands to ensure that it is effective and workable. Public comments on the proposed changes were received through January 1992 and are currently being reviewed.

- **Regulatory system.** The federal government is reforming the wetlands regulatory system by streamlining the permitting process for activities that affect wetlands, creating a market-based mitigation banking system based on wetlands categories, expanding the scope of activities that require permits to include draining and dredging, and taking other measures.

among federal agencies by establishing government-wide technical criteria and procedures for use in identifying wetlands regulated under section 404 of the Clean Water Act and the Swampbuster provisions of the 1985 Farm Bill.

However, the 1989 manual had the effect of bringing many areas under regulation that may not have had the traditional functions of wetlands. Since its release, the manual has been the subject of many public comments, four public hearings, and interagency consultation, which culminated in August 1991 in proposed revisions to the manual. Public comment on the proposed revisions were received through January 1992 and are currently being reviewed.

Improving and Streamlining Wetlands Regulation. Under section 404 of the Clean Water Act, a landowner must receive a permit from the Army Corps of Engineers before adding dredged or fill material into a wetland, unless the activity is specifically exempted under section 404(f) of the Act. The following provisions would reform the regulatory program:

- Expanding the scope of activities requiring permits to include draining and dredging;
- Streamlining the permitting process by issuing decisions in most cases within six months, increasing reliance on pre-application conferences, expanding the use of general

C.J. Badger, Virginia Coast Reserve.

With progress in protecting coastal and freshwater wetlands, the nation moves toward the President's goal of no net loss.

permits for low-impact activities, and clarifying that the Corps of Engineers will act as "project manager" on permitting decisions; and

- Increasing the state role by encouraging greater state assumption of the permitting process, tailoring federal programs to unique state conditions and resources, and encouraging the use of state and regional general permits.

Mitigation Banking. The President's proposals to reform the permitting process include developing market incentives for private sector restoration and creation of wetlands. Under the current permitting system, many applications for individual permits are evaluated through a sequencing process. Sequencing requires applicants to avoid negative impacts; or if that is not practicable, to minimize such impacts; finally, if that is not practicable, to compensate for such impacts with mitigation measures, usually restoration or creation of wetlands—preferably on or near the site. Sequencing involves case-by-case scrutiny and is often a source of confusion and frustration for landowners.

Under the proposed system, sequencing would be replaced in most cases by a more predictable, formulaic approach that would harness market forces for environmental protection. Wetlands would be categorized by their ecological functions, societal value, and relative scarcity. Compensatory mitigation for all categories would be maintained, but sequencing and stringent regulatory review would be required only for the highest value category of wetlands. A market-oriented mitigation banking system would be based on wetlands categories. Wetlands created or restored by private entities could be "banked" as "credits" against permitted losses. Permits for development would be issued upon presentation of evidence that compensatory mitigation requirements were met. Private entities would have an incentive to restore wetlands,

bank them, and then use or sell these credits to meet compensatory mitigation requirements within geographic limits and wetlands categories. This approach is designed to assure a lasting national base of wetlands within a context of economic development and respect for private property rights.

Legislation. While many of the Administration's wetlands proposals can be implemented by administrative action, other measures, such as expanding the number of regulated activities and delegating permitting authority to states, require Congressional approval. In 1991 Congress held hearings on several legislative proposals to revise the section 404 program. Legislative action on the President's wetlands proposals could occur in conjunction with upcoming Congressional reauthorization of the Clean Water Act.

Wetlands Restoration

In July 1991 NOAA established a Restoration Center within the National Marine Fisheries Service as a focus for habitat creation and enhancement. NOAA organized the Center in response to its expanding role as federal trustee for coastal resources and habitats. The Center oversees restoration-related activities associated with claims for damage to natural resources resulting from discharges of oil or hazardous materials. The Center also is responsible for basic and applied research for several purposes:

- To advance understanding of habitat functioning and response to natural and human-induced environmental changes;
- To develop improved techniques for habitat restoration and assessment; and
- To support the habitat permit-review process within the agency.

Such investigations are pursuant to the Coastal Wetlands Planning, Protection and Restoration Act (the "Breaux Bill"), the Administration's Coastal America initiative, and a Memorandum of Agreement between NOAA and the Army Corps of Engineers for the creation of fisheries habitat.

Wetlands Monitoring

The Emergency Wetlands Resources Act requires the DOI/Fish and Wildlife Service to monitor and report on the status and trends of U.S. wetlands on a 10-year cycle. In 1991, based on the National Wetlands Inventory, the Fish and Wildlife Service sent two status and trends reports to Congress: *Wetlands Losses in the United States: 1970s to 1980s* and *Wetlands Status and Trends in the Conterminous United States, Mid-1970s to Mid-1980s.* The status report was the first update of an earlier publication, *Wetlands of the United States: Current Status and Recent Trends*, covering the mid-1950s to the mid-1970s.

PART II: Environmental Data and Trends

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Population

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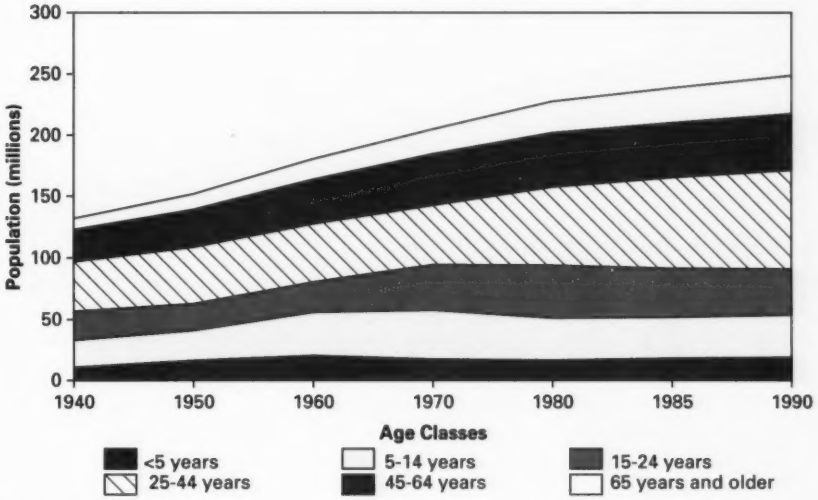
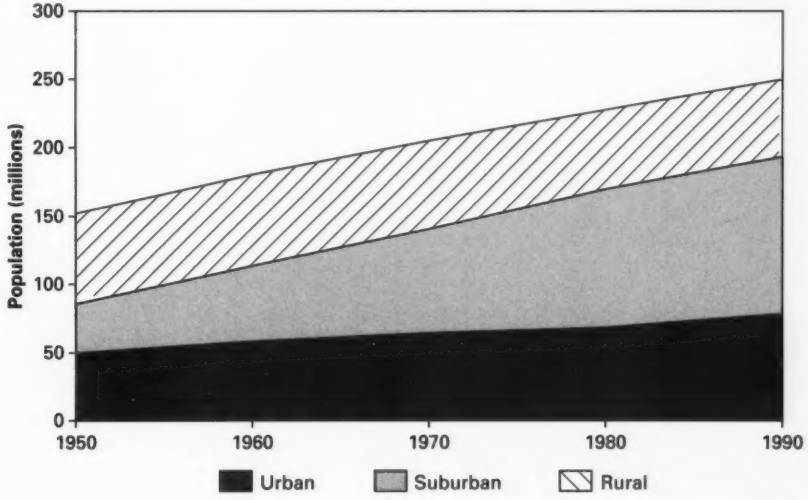


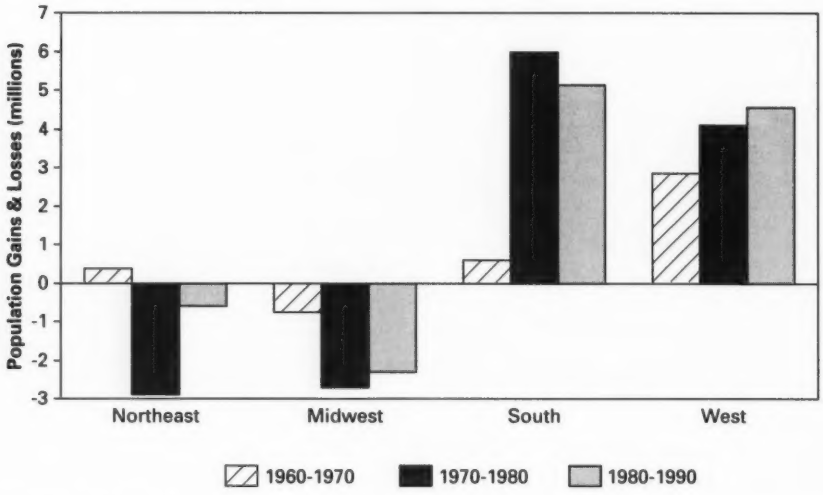
Source: See Table 3.

Figure 2.—Urban, suburban, and rural population of the United States, 1950-1990.



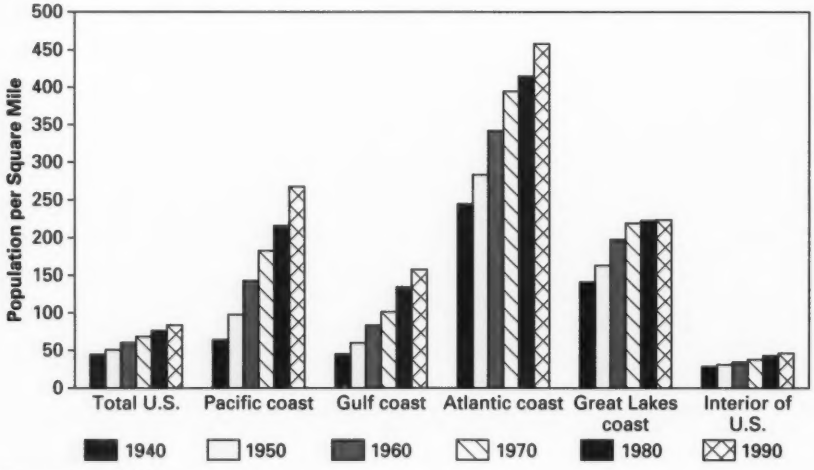
Source: See Table 4.

Figure 3.—Population migration, by region, 1960-1990.



Source: See Table 5.

Figure 4.—Population density, 1940-1990.



Source: See Table 6.

Table 1.—Total population and population growth rate, 1900-1991.

Year	Population	Growth rate	Year	Population	Growth rate	Year	Population	Growth rate
	millions	%		*millions*	%		*millions*	%
1900	76.09	na	1931	124.15	0.7	1962	186.54	1.5
1901	77.58	2.0	1932	124.95	0.6	1963	189.24	1.4
1902	79.16	2.0	1933	125.69	0.6	1964	191.89	1.3
1903	80.63	1.9	1934	126.49	0.7	1965	194.30	1.2
1904	82.17	1.9	1935	127.36	0.7	1966	196.56	1.1
1905	83.82	2.0	1936	128.18	0.6	1967	198.71	1.1
1906	85.45	1.9	1937	128.96	0.7	1968	200.71	1.0
1907	87.01	1.8	1938	129.97	0.8	1969	202.68	1.0
1908	88.71	2.0	1939	131.03	0.8	1970	205.05	1.3
1909	90.49	2.0	1940	132.59	0.9	1971	207.66	1.2
1910	92.41	2.1	1941	133.89	1.0	1972	209.90	1.0
1911	93.86	1.6	1942	135.36	1.3	1973	211.91	0.9
1912	95.34	1.6	1943	137.25	1.3	1974	213.85	0.9
1913	97.23	2.0	1944	138.92	1.2	1975	215.97	1.0
1914	99.11	1.9	1945	140.47	1.0	1976	218.04	1.0
1915	100.55	1.4	1946	141.94	1.5	1977	220.24	1.0
1916	101.96	1.4	1947	144.70	1.8	1978	222.59	1.1
1917	103.41	1.4	1948	147.21	1.7	1979	225.06	1.2
1918	104.55	1.1	1949	149.77	1.7	1980	227.72	1.1
1919	105.06	0.5	1950	152.27	1.7	1981	229.96	1.0
1920	106.46	1.3	1951	154.88	1.7	1982	232.19	1.0
1921	108.54	2.0	1952	157.55	1.7	1983	234.32	1.0
1922	110.05	1.4	1953	160.18	1.7	1984	236.37	0.9
1923	111.95	1.7	1954	163.03	1.8	1985	238.49	1.0
1924	114.11	1.9	1955	165.93	1.8	1986	240.68	1.0
1925	115.83	1.5	1956	168.90	1.8	1987	242.84	1.0
1926	117.40	1.4	1957	171.98	1.7	1988	245.06	1.0
1927	119.04	1.4	1958	174.88	1.7	1989	247.34	1.0
1928	120.51	1.2	1959	177.83	1.7	1990	249.98	1.0
1929	121.77	1.0	1960	180.67	1.6	1991	252.86	1.0
1930	123.19	0.9	1961	183.69	1.6			

Source: U.S. Department of Commerce, Bureau of the Census, Estimates of the Population of the United States to August 1, 1991. Current Population Reports, series P-25, no. 1078, (Washington, DC: DOC, October 1991).

Notes: The population estimates shown here are based on the April 1, 1990, population as enumerated in the 1990 census. Estimates for dates prior to April 1, 1990, have been revised. Except for 1991, annual population estimates are as of July 1 for the given year. Total population includes Armed Forces oversees.

Table 2.—Components of total population change, 1940-1989.

Year	Births	Deaths	Net civilian immigration	Net change
		millions		
1940	2.570	1.432	0.077	1.221
1945	2.873	1.549	0.162	1.462
1950	3.645	1.468	0.299	2.486
1955	4.128	1.537	0.337	2.925
1960	4.307	1.708	0.328	2.901
1965	3.801	1.830	0.373	2.315
1970	3.739	1.927	0.438	2.617
1975	3.144	1.894	0.449	2.165
1980	3.612	1.990	0.845	2.582
1985	3.761	2.087	0.650	2.325
1989	3.977	2.155	0.682	2.505

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Population Estimates, by Age, Sex, and Race, and Hispanic Origin: 1989, Current Population Reports, series P-25, no. 1057, and earlier reports in this series, (Washington, DC: DOC, 1990).

Note: Annual population estimate as of July 1.

Table 3.—Age structure of the population, including Armed Forces overseas, 1940-1990.

Year	Population, by age class, in years							
	< 5	5-14	15-24	25-34	35-44	45-54	55-64	> 64
	millions							
1940	10.6	22.3	24.0	21.5	18.4	15.6	10.7	9.0
1950	16.3	24.5	22.3	23.9	21.6	17.4	13.4	12.4
1960	20.3	35.7	24.6	22.9	24.2	20.6	15.6	16.7
1970	17.2	40.7	36.5	25.3	23.1	23.3	18.7	20.1
1980	16.5	34.8	42.7	37.6	25.9	22.8	21.8	25.7
1985	18.0	33.9	39.6	42.1	31.8	22.6	22.3	28.5
1990	18.8	35.1	37.0	43.2	37.4	25.1	21.1	31.1

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series A 30-37, (Washington, DC: DOC, 1976).

U.S. Department of Commerce, Bureau of the Census, U.S. Population Estimates, by Age, Sex, and Race, and Hispanic Origin: 1989, Current Population Reports, series P-25, no. 1057, and earlier reports in this series, (Washington, DC: DOC, 1990).

U.S. Department of Commerce, Bureau of the Census, Age, Sex, Race, and Hispanic Origin Information From the 1990 Census: A Comparison of Census Results With Results Where Age and Race Have Been Modified, 1990 CPH-L-74, (Washington, DC: DOC, 1991).

Note: Annual population estimate as of July 1, except for 1990 which is April 1.

Table 4.—Population in urban, suburban, and rural areas, 1950-1990.

Year	Urban population		Suburban population		Rural population	
	millions	*%*	*millions*	*%*	*millions*	*%*
1950	49.95	32.80	35.48	23.30	66.84	43.90
1960	58.36	32.30	55.29	30.60	67.03	37.10
1970	64.39	31.40	76.28	37.20	64.38	31.40
1980	68.32	30.00	102.02	44.80	57.38	25.20
1990	78.24	31.30	115.47	46.19	56.27	22.51

Source: U.S. Department of Commerce, Bureau of the Census, Population Censuses 1950 to 1990, (Washington, DC: DOC, 1991).

Notes: Urban population refers to population living inside central cities of Metropolitan Statistical Areas (MSAs). Suburban population refers to population living in MSA suburbs outside central cities. Rural population refers to nonmetropolitan population.

Table 5.—Net population migration, by region, 1960-1991.

Region	Gains and losses			
	1960-1970	1970-1980	1980-1990	1990-1991
		millions		
Northeast	0.375	-2.888	-0.592	-0.237
Midwest	-0.752	-2.703	-2.293	0.046
South	0.592	5.992	5.143	0.653
West	2.854	4.115	4.568	0.490

Source: U.S. Department of Commerce, Bureau of the Census, Patterns of Metropolitan Area and County Population Growth: 1980 to 1987, Current Population Reports, series P-25, no. 1039, and earlier reports in this series, (Washington, DC: DOC, 1989).

Notes: Migration for 1980-1990 is from components of population change used in developing postcensal 1980-based state population estimates. Migration for 1990-1991 is from components of population change used to develop the July 1, 1991 state estimates.

Table 6.—Population density, 1940-1990.

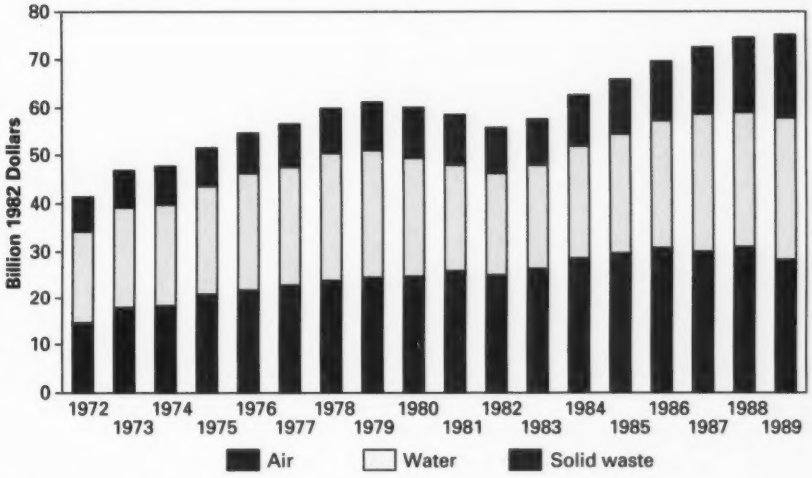
Year	Total conterminous United States	Counties in coastal regions				Interior of U.S.
		Pacific	Gulf of Mexico	Atlantic	Great Lakes	
			population per square mile			
1940	44.4	64.1	44.8	244.4	140.9	28.5
1950	50.8	97.6	59.8	283.3	162.9	30.9
1960	60.2	142.7	83.1	341.6	197.3	34.3
1970	68.2	182.5	101.1	394.4	219.1	37.6
1980	76.0	215.8	134.1	414.9	222.4	42.8
1985	79.1	231.5	149.3	429.7	221.4	44.6
1990	83.5	267.6	157.4	458.2	223.4	46.1

Source: U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, annual, and 1980 and 1990 population censuses, (Washington, DC: DOC).

Note: Coastal area includes 611 counties and independent cities which are entirely or substantially within 50 miles of the U.S. conterminous coast.

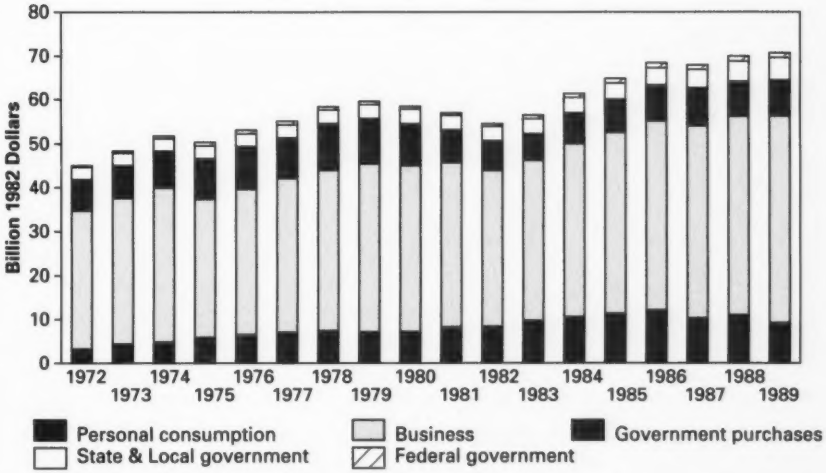
Economy and the Environment

Figure 5a.—Pollution abatement expenditures, by type of pollution, 1972-1989.



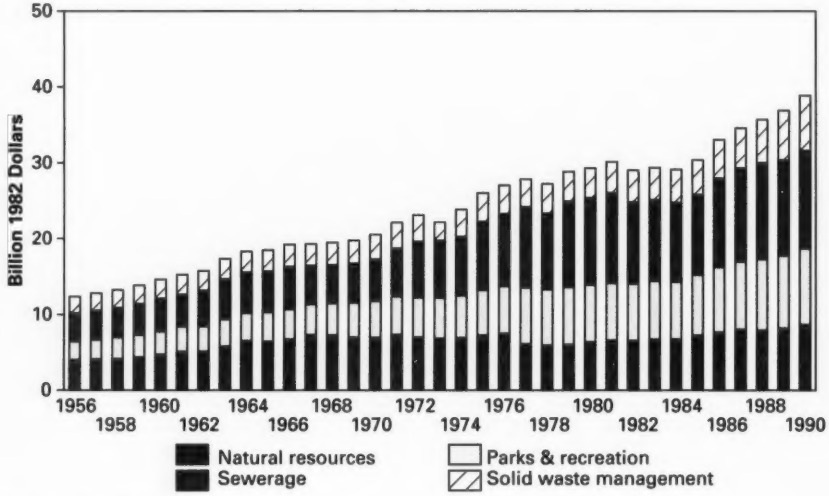
Source: See Table 9.

Figure 5b.—Pollution abatement expenditures, by sector, 1972-1989.



Note: Government purchases=fixed capital for publicly owned electric utilities and public sewer systems.
Source: See Table 10.

Figure 6.—State and local government expenditures on the environment, 1956-1990.



Source: See Table 13.

Table 7.—Gross national product, 1929-1991.

Year	Current dollars	1982 dollars
	billion $	
1929	103.9	709.6
1935	72.8	580.2
1940	100.4	772.9
1945	213.4	1,354.8
1950	288.3	1,203.7
1955	405.9	1,494.9
1960	515.3	1,665.3
1965	705.1	2,087.6
1970	1,015.5	2,416.2
1975	1,598.4	2,695.0
1980	2,732.0	3,187.1
1985	4,014.9	3,618.7
1989	5,200.8	4,117.7
1990	5,463.0	4,155.8
1991	5,670.8	4,143.1

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, quarterly issues, (Washington, DC: DOC, 1991).

Executive Office of the President, Council on Economic Advisers,1991 Economic Report, (Washington, DC: CEA, 1991).

Note: The 1991 GNP is estimated for the third quarter of the calendar year.

Table 8.—Pollution abatement and control expenditures, 1972-1989.

Year	Pollution abatement		Regulation & monitoring		Research & development		Total	
	Current	Constant	Current	Constant	Current	Constant	Current	Constant
	billion $							
1972	16.7	40.3	0.4	0.8	0.8	1.9	18.1	43.0
1973	20.4	45.8	0.5	1.0	0.9	2.0	21.8	48.8
1974	24.0	46.7	0.6	1.1	1.0	2.0	25.6	49.8
1975	28.4	50.4	0.7	1.1	1.1	2.0	30.2	53.5
1976	31.9	53.2	0.7	1.2	1.3	2.2	33.9	56.5
1977	35.3	55.1	0.8	1.2	1.5	2.3	37.6	58.7
1978	40.1	58.3	1.0	1.3	1.7	2.4	42.7	62.1
1979	45.9	59.5	1.1	1.4	1.8	2.4	48.7	63.3
1980	50.5	58.4	1.3	1.5	1.8	2.1	53.5	62.1
1981	54.3	57.0	1.4	1.5	1.8	1.9	57.5	60.3
1982	54.5	54.5	1.4	1.4	1.8	1.8	57.7	57.7
1983	58.1	56.5	1.4	1.3	2.3	2.3	61.8	60.0
1984	65.2	61.3	1.4	1.2	2.3	2.2	68.9	64.7
1985	71.0	64.9	1.3	1.1	2.4	2.2	74.6	68.1
1986	74.6	68.2	1.5	1.3	2.6	2.3	78.7	71.3
1987	77.3	67.8	1.5	1.2	2.7	2.3	81.5	71.4
1988	81.6	70.0	1.7	1.3	2.8	2.3	86.1	73.6
1989	86.6	70.8	1.8	1.3	3.0	2.4	91.4	74.4

Source: G.L. Rutledge & M.L. Leonard, Pollution abatement and control expenditures, 1987-89, Survey of Current Business, table 7, p. 49, (Washington, DC: DOC, BEA, November 1991).

Bratton, D.M. & G.L. Rutledge, Pollution abatement and control expenditures, 1985-88, Survey of Current Business, table 7, pp. 36-37, (Washington, DC: DOC, BEA, November 1990).

Notes: Constant=1982 $. Pollution abatement and control (PAC) spending is for goods and services that U.S. residents use to produce cleaner air and water and to dispose of solid waste. PAC spending consists of expenditures associated with pollution abatement, regulation and monitoring, and research and development. Data do not include interest costs. Totals may not agree with detail because of independent rounding.

Table 9.—Pollution abatement expenditures, by type of pollution, 1972-1989.

Year	Air		Water		Solid waste	
	Current	Constant	Current	Constant	Current	Constant
	billion $					
1972	5.6	14.6	8.5	19.7	3.3	7.1
1973	7.3	17.9	9.7	21.3	3.7	7.6
1974	9.1	18.3	11.2	21.5	4.3	7.9
1975	11.4	20.8	13.0	22.8	4.7	7.9
1976	12.6	21.7	14.9	24.5	5.2	8.4
1977	14.1	22.8	16.1	24.7	6.0	9.1
1978	15.7	23.8	19.0	26.6	6.5	9.5
1979	18.6	24.5	20.8	26.5	7.8	10.2
1980	21.9	24.7	21.3	24.7	8.8	10.7
1981	25.1	25.9	20.8	22.0	10.0	10.7
1982	25.0	25.0	21.2	21.2	9.6	9.6
1983	26.6	26.4	22.4	21.5	10.2	9.7
1984	29.6	28.6	25.2	23.3	11.8	10.8
1985	31.2	29.7	27.6	24.7	13.1	11.5
1986	31.2	30.8	29.7	26.5	14.7	12.3
1987	32.0	30.0	33.0	28.7	17.1	13.8
1988	34.1	31.0	32.9	28.0	20.0	15.5
1989	32.7	28.3	36.0	29.6	23.2	17.2

Source: G.L. Rutledge & M.L. Leonard, Pollution abatement and control expenditures, 1987-89, Survey of Current Business, table 7, p. 49, (Washington, DC: DOC, BEA, November 1991).

Bratton, D.M. & G.L. Rutledge, Pollution abatement and control expenditures, 1985-88, Survey of Current Business, table 7, pp. 36-37, (Washington, DC: DOC, BEA, November 1990).

Notes: Constant=1982 $. Expenditures are attributed to the sector that performs the air or water pollution abatement or solid waste collection and disposal. Data do not include interest costs. Totals may not agree with detail because of independent rounding.

Table 10.—Pollution abatement and control expenditures, by sector, 1972-1989.

	Pollution abatement					Regulation & monitoring		Research & development		
	Private		Government							
Year	Pers'l	Bus.	Fed.	State	Other	Fed.	State	Prv't	Fed.	State
	billion 1982 $									
1972	3.26	31.50	0.35	2.85	7.07	0.40	0.38	1.26	0.47	0.21
1973	4.34	33.23	0.46	2.88	7.46	0.53	0.45	1.30	0.58	0.13
1974	4.79	35.18	0.58	2.85	8.39	0.61	0.48	1.25	0.67	0.07
1975	5.90	31.50	0.80	2.94	9.27	0.62	0.48	1.12	0.80	0.08
1976	6.46	33.23	0.81	2.92	9.73	0.62	0.53	1.22	0.88	0.07
1977	6.97	35.18	0.78	2.95	9.22	0.62	0.62	1.37	0.90	0.08
1978	7.37	36.63	0.68	3.10	10.56	0.69	0.64	1.48	0.85	0.08
1979	7.09	38.35	0.71	3.15	10.25	0.76	0.64	1.54	0.75	0.09
1980	7.16	37.89	0.58	3.29	9.50	0.93	0.61	1.31	0.70	0.08
1981	8.20	37.54	0.53	3.23	7.45	0.87	0.61	1.16	0.69	0.04
1982	8.32	35.61	0.55	3.27	6.75	0.82	0.58	1.15	0.60	0.03
1983	9.73	36.53	0.77	3.38	6.04	0.77	0.55	1.59	0.62	0.03
1984	10.57	39.50	0.88	3.51	6.87	0.68	0.55	1.58	0.55	0.02
1985	11.34	41.28	1.09	3.72	7.42	0.51	0.60	1.62	0.53	0.02
1986	12.15	43.07	1.18	3.95	8.14	0.62	0.67	1.69	0.58	0.03
1987	10.31	43.78	1.04	4.26	8.58	0.59	0.65	1.74	0.54	0.02
1988	11.04	45.17	1.13	4.67	7.97	0.68	0.66	1.74	0.55	0.02
1989	9.20	47.10	1.07	5.17	8.19	0.65	0.70	1.74	0.62	0.02

Source: G.L. Rutledge & M.L. Leonard, Pollution abatement and control expenditures, 1987-89, Survey of Current Business, table 7, p. 49, (Washington, DC: DOC, BEA, November 1991).

Bratton, D.M. & G.L. Rutledge, Pollution abatement and control expenditures, 1985-88, Survey of Current Business, table 7, pp. 36-37, (Washington, DC: DOC, BEA, November 1990).

Notes: Expenditures are attributed to the sector that performs the air or water pollution abatement or solid waste collection and disposal. State also includes expenditures by local authorities but excludes agricultural production except feedlot operations. Pers'l=Personal consumption (all of which is to purchase and operate motor vehicle emission abatement devices). Bus.=Business. Fed.=Federal government. Prv't=Private (=business spending). Other government spending refers to government enterprise fixed capital for publicly owned electric utilities and public sewer systems. Data do not include interest costs. Totals may not agree with detail on preceding tables because of independent rounding.

Table 11.—Pollution abatement expenditures, by industry, 1973-1989.*

Year	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
Chemicals and allied products									
1973	164.4	214.6	16.8	395.9	174.1	247.6	80.2	502.3	83.1
1974	250.6	264.4	24.1	539.2	203.8	335.6	104.0	643.3	104.5
1975	359.5	387.7	35.0	780.2	249.9	430.9	126.7	807.4	140.7
1976	319.8	577.4	44.7	942.0	295.6	514.7	173.2	983.5	188.7
1977	339.9	593.1	49.6	982.5	335.5	685.2	217.6	1,238.3	206.4
1978	376.3	385.9	65.1	827.5	398.8	794.1	280.1	1,473.0	231.3
1979	314.6	360.7	95.6	770.9	485.3	895.2	287.0	1,667.5	230.4
1980	325.9	350.0	104.8	780.7	539.9	942.9	368.8	1,851.8	305.9
1981	335.0	322.2	95.6	752.8	571.7	1,069.1	406.9	2,047.8	341.1
1982	272.8	256.5	98.3	627.6	556.1	1,112.3	438.2	2,106.5	345.2
1983	159.0	187.4	49.0	395.4	624.9	1,106.0	467.4	2,198.2	297.4
1984	142.9	212.4	32.7	418.1	622.0	1,206.3	517.1	2,345.4	357.5
1985	193.7	271.5	272.5	738.1	672.9	1,267.7	599.4	2,540.0	268.6
1986	197.8	325.5	101.0	624.4	646.5	1,301.8	705.9	2,654.3	336.4
1988	370.7	487.8	236.5	1,095.0	706.4	1,428.5	940.1	3,074.9	443.8
1989	380.3	598.6	215.9	1,194.8	794.0	1,613.8	1,101.4	3,509.2	395.9
1990	596.0	994.0	261.0	1,851.0	858.0	1,797.0	1,293.0	3,948.0	na
Petroleum and coal products									
1973	222.5	96.1	3.2	321.8	192.5	125.4	19.9	337.8	44.3
1974	341.3	119.7	1.3	462.3	238.3	153.3	28.5	420.1	83.5
1975	398.2	155.7	1.7	555.7	339.4	192.1	31.7	563.1	137.7
1976	236.5	199.8	5.2	441.4	466.1	263.3	45.3	774.8	183.8
1977	167.7	195.6	5.3	368.5	601.3	289.3	57.4	948.0	238.4
1978	311.2	100.5	7.6	419.3	636.4	304.1	57.0	997.4	261.8
1979	397.8	119.4	17.1	534.3	750.7	370.8	25.3	1,173.8	324.1
1980	402.3	114.2	15.4	531.9	910.1	406.9	101.0	1,418.0	506.7
1981	440.8	131.7	18.2	590.6	1,118.0	437.2	130.2	1,685.5	565.6
1982	533.2	165.7	13.1	712.1	1,195.1	472.0	133.7	1,800.8	335.3
1983	308.2	164.7	12.0	485.0	1,203.6	552.3	137.9	1,893.7	524.9
1984	195.1	96.8	19.8	311.7	1,327.9	583.8	171.1	2,083.5	552.8
1985	175.0	88.4	27.0	290.4	1,278.5	586.5	198.5	2,063.4	500.0
1986	273.6	121.5	29.2	424.3	1,230.9	578.0	196.4	2,005.2	498.2
1988	208.2	203.7	70.8	482.8	1,175.8	547.1	252.1	2,005.5	480.0
1989	146.5	230.4	40.7	417.6	1,258.2	578.7	333.0	2,170.0	523.1
1990	426.0	401.0	90.0	917.0	1,472.0	702.0	531.0	2,705.0	na

continued

* Except for 1987 when the study was not conducted.

Table 11 (continued).—Pollution abatement expenditures, by industry, 1973-1989.

	Rubber and miscellaneous plastic products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	13.5	7.3	3.3	24.2	12.2	10.1	20.4	42.6	4.6
1974	22.2	13.5	2.2	37.9	15.7	15.1	28.2	58.8	19.5
1975	22.2	6.6	3.1	31.9	20.7	18.4	25.7	64.8	12.5
1976	24.2	10.0	3.1	37.4	22.3	24.0	34.0	80.3	15.8
1977	17.4	13.8	5.4	36.6	19.8	18.9	35.1	73.8	7.7
1978	18.7	5.5	3.4	27.7	17.7	23.9	43.3	84.9	8.0
1979	12.9	9.3	2.9	25.1	32.2	29.6	49.9	111.7	13.6
1980	12.6	6.9	2.3	21.7	30.4	27.6	50.2	108.2	18.1
1981	15.3	5.9	6.5	21.8	29.8	29.4	58.8	118.3	14.0
1982	14.8	7.7	2.7	25.2	22.2	28.2	39.8	90.2	7.0
1983	12.0	3.8	7.8	23.6	50.9	52.8	62.0	165.8	6.6
1984	20.5	7.0	5.8	33.4	51.1	48.7	68.1	168.0	9.9
1985	21.3	3.2	5.2	29.7	46.7	55.6	90.8	193.1	10.0
1986	20.1	9.7	6.2	36.0	50.9	52.0	123.3	226.2	15.1
1988	21.7	11.3	7.8	40.7	62.5	62.2	153.3	227.9	18.7
1989	50.3	16.0	12.0	78.2	85.3	99.6	218.4	403.3	25.6
1990	69.0	11.0	14.0	94.0	97.0	113.0	218.0	428.0	na

	Stone, clay, and glass products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	131.6	14.4	4.7	150.7	73.7	16.4	27.0	117.0	24.5
1974	185.8	13.1	10.0	208.8	98.7	24.7	29.4	152.9	33.1
1975	152.7	16.7	4.1	173.5	109.7	28.3	33.8	171.8	41.7
1976	82.2	18.9	3.6	104.7	122.8	30.3	39.0	192.1	59.3
1977	85.8	39.1	8.6	133.4	141.7	28.0	44.5	214.5	68.7
1978	98.1	28.0	3.7	123.8	163.7	33.2	54.2	251.1	74.8
1979	110.2	25.4	10.0	145.6	188.0	45.1	60.5	293.6	82.4
1980	123.1	17.9	10.0	151.0	182.1	48.2	71.4	301.7	83.9
1981	165.5	13.8	9.2	188.5	191.0	47.3	72.5	310.7	91.5
1982	84.9	14.0	6.3	105.2	142.8	44.0	39.8	260.2	56.0
1983	57.9	9.8	28.2	95.9	179.9	55.8	84.6	320.4	45.2
1984	65.6	13.1	5.2	84.0	215.0	64.2	98.7	377.9	46.2
1985	44.4	9.9	7.5	61.9	217.2	66.7	109.3	393.2	31.5
1986	53.1	13.7	17.6	84.4	237.0	68.2	118.3	423.6	46.7
1988	42.6	13.6	6.1	62.3	247.7	67.7	123.1	438.4	103.3
1989	73.2	17.1	7.0	97.3	328.4	85.0	178.3	591.7	52.3
1990	94.0	20.0	14.0	128.0	248.0	93.0	157.0	498.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by industry, 1973-1989.

Primary metal industries									
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	397.2	84.7	16.8	498.6	264.7	148.3	53.8	466.8	51.5
1974	510.5	132.7	12.5	646.8	339.6	181.2	69.5	590.2	76.9
1975	640.6	187.5	5.4	833.5	429.9	209.4	75.9	715.2	95.3
1976	632.5	197.8	3.4	833.7	575.7	229.5	90.7	895.8	100.7
1977	616.0	250.2	8.4	874.6	721.6	268.3	132.3	1,122.3	126.3
1978	563.3	219.1	9.4	791.8	809.6	333.0	178.9	1,321.4	141.7
1979	588.8	227.3	6.9	823.1	981.7	442.0	163.5	1,587.2	241.8
1980	539.7	180.7	19.6	740.0	998.2	463.2	215.3	1,677.3	169.5
1981	567.2	144.1	16.9	728.2	1,111.9	549.2	250.7	1,911.8	189.7
1982	423.1	133.7	13.0	569.8	897.2	448.4	167.6	1,513.6	148.5
1983	147.6	100.2	7.5	225.3	904.3	454.6	256.7	1,615.6	95.4
1984	175.2	72.9	26.0	274.0	1,017.3	450.7	301.7	1,769.7	171.6
1985	142.9	84.3	25.6	252.9	1,067.0	517.4	278.7	1,863.0	136.8
1986	102.8	74.6	48.4	225.9	968.5	509.4	264.1	1,721.9	184.6
1988	167.3	100.6	41.8	309.8	965.8	516.1	327.2	1,809.0	189.8
1989	216.3	138.7	52.1	407.0	883.1	574.3	473.7	1,931.1	190.4
1990	279.0	167.0	54.0	499.0	944.0	565.0	545.0	2,054.0	na

Fabricated metal products									
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	39.6	21.5	2.7	63.7	27.0	35.7	22.2	84.8	9.1
1974	56.4	28.2	5.9	90.5	34.5	44.9	30.7	110.1	8.2
1975	46.9	29.0	1.7	77.5	32.6	45.7	31.3	109.5	7.5
1976	35.5	34.1	3.4	72.9	35.4	52.7	36.1	124.3	6.3
1977	32.5	39.2	5.0	76.7	40.3	66.1	42.8	149.2	3.5
1978	33.1	26.2	2.3	61.6	42.1	73.8	52.8	168.7	4.5
1979	36.7	24.5	4.9	66.1	57.0	99.7	64.2	220.9	13.4
1980	37.5	34.8	4.2	76.4	49.0	88.2	81.9	219.2	23.9
1981	37.5	30.4	7.6	75.7	51.6	93.4	85.0	230.5	21.5
1982	57.9	43.3	6.7	95.9	48.6	103.4	71.5	223.5	13.0
1983	27.0	32.9	10.6	70.6	81.9	137.8	146.6	366.3	17.7
1984	25.2	82.5	17.6	125.3	64.9	128.2	155.4	348.5	37.0
1985	40.4	59.7	16.8	116.9	79.4	163.2	165.5	408.1	15.4
1986	36.7	80.9	18.2	135.8	95.6	187.7	219.2	502.5	27.1
1988	45.5	75.3	26.1	146.8	135.0	316.8	310.1	761.9	29.1
1989	50.5	71.3	29.2	151.0	123.3	389.4	382.4	895.7	21.9
1990	53.0	61.0	57.0	171.0	114.0	344.0	356.0	814.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by industry, 1973-1989.

	Machinery, except electrical								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	36.6	15.6	4.1	56.3	19.7	23.0	29.9	72.5	14.3
1974	41.9	17.6	8.1	67.7	24.3	29.1	38.2	91.7	11.0
1975	37.5	20.8	2.3	60.5	28.4	33.7	36.0	98.0	11.9
1976	44.8	21.8	2.9	69.4	30.8	37.7	49.6	117.9	15.9
1977	42.3	42.4	5.5	90.2	33.1	49.8	52.6	135.4	17.6
1978	41.2	27.8	12.6	81.5	41.0	54.4	63.1	158.8	14.8
1979	38.5	38.2	7.8	84.5	50.1	69.0	81.1	200.2	19.9
1980	34.0	34.9	5.6	74.5	48.0	73.0	85.3	206.4	17.6
1981	30.9	28.0	8.2	67.1	47.3	81.6	91.7	220.9	18.1
1982	29.2	42.2	6.8	78.2	46.6	85.3	75.7	207.6	11.4
1983	17.7	19.0	14.3	51.0	58.0	105.0	127.5	290.5	18.8
1984	13.8	22.6	6.7	43.1	68.4	115.7	130.3	314.4	15.8
1985	21.2	35.1	12.7	69.0	76.0	119.9	147.7	344.0	12.1
1986	16.7	25.7	6.3	48.7	81.4	128.3	149.1	358.8	12.6
1988	21.8	33.2	22.3	77.2	68.4	139.4	221.8	429.6	14.7
1989	99.8	54.8	14.9	169.5	80.6	170.5	320.8	571.9	13.9
1990	46.0	41.0	20.0	107.0	78.0	159.0	320.0	577.0	na

	Electric, electronic equipment								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	27.0	22.2	3.5	52.7	20.2	38.9	28.1	87.2	18.5
1974	24.6	28.0	3.1	55.6	22.7	39.8	26.2	88.6	20.3
1975	22.7	26.2	3.3	52.3	27.6	43.1	26.7	97.3	14.3
1976	23.0	31.3	4.1	58.4	26.8	50.8	32.3	109.9	23.7
1977	23.0	36.0	4.9	63.8	28.0	63.2	37.1	128.1	16.0
1978	32.9	36.0	3.3	72.2	30.7	71.7	46.1	148.6	12.9
1979	41.8	42.0	7.1	90.9	46.7	82.8	52.8	182.3	24.1
1980	43.5	27.1	8.4	79.0	45.2	87.8	71.9	205.0	17.0
1981	48.7	41.0	7.4	97.1	51.8	106.2	88.8	247.1	22.0
1982	58.1	40.9	6.9	105.9	55.1	116.6	88.7	260.2	14.2
1983	43.8	45.1	8.0	97.0	77.3	142.0	134.5	353.8	15.1
1984	38.3	59.5	14.6	112.4	74.6	150.3	139.1	364.0	18.3
1985	45.4	74.1	18.3	137.7	78.0	174.0	176.3	428.2	15.2
1986	46.6	61.5	17.0	125.1	88.3	210.9	231.5	530.8	19.4
1988	80.6	54.6	19.0	154.2	92.2	252.5	314.6	659.3	39.1
1989	66.6	94.3	27.8	188.7	100.9	308.9	319.3	729.1	29.3
1990	93.0	58.0	26.0	178.0	113.0	370.0	304.0	788.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by industry, 1973-1989.

Year	Transportation equipment								
	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	52.6	41.7	6.9	101.2	35.2	51.1	43.4	129.8	20.1
1974	52.7	41.5	9.2	103.4	44.8	59.5	50.5	154.8	13.6
1975	32.1	36.4	6.8	75.4	52.2	66.4	49.7	168.3	13.4
1976	21.1	53.6	3.8	78.5	56.9	83.5	57.6	197.9	14.5
1977	36.9	39.4	6.3	82.6	60.6	97.3	76.1	233.9	13.5
1978	71.0	57.9	10.7	139.5	77.3	110.2	93.0	280.5	16.6
1979	120.1	59.5	99.9	189.5	96.4	126.3	109.1	331.8	36.9
1980	201.4	60.7	12.9	275.0	110.7	137.4	153.2	401.5	24.6
1981	209.2	60.0	14.2	283.3	117.5	150.7	157.7	426.1	19.3
1982	59.7	36.5	12.1	108.3	105.6	153.5	137.6	396.5	18.2
1983	33.0	55.0	10.2	98.3	157.5	224.2	178.6	560.3	22.3
1984	71.3	116.9	19.4	207.6	192.9	280.1	212.6	685.6	22.7
1985	254.5	165.1	36.9	456.5	194.5	283.9	260.3	738.8	23.7
1986	432.4	81.8	26.8	541.1	195.7	338.5	304.9	839.0	28.2
1988	87.6	80.4	42.2	210.2	215.7	299.2	459.5	974.4	38.7
1989	156.0	84.6	46.2	286.8	212.2	318.1	470.1	1,000.3	43.1
1990	207.0	143.0	46.0	395.0	247.0	373.0	612.0	1,232.0	na

Year	Instruments and related products								
	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	3.0	5.6	3.2	11.8	2.0	11.3	8.6	21.9	2.2
1974	3.6	6.7	5.5	15.7	4.9	15.0	14.3	34.1	3.5
1975	11.2	17.3	1.1	29.6	5.9	19.5	13.2	38.5	4.3
1976	10.9	12.2	9.3	32.3	8.7	22.3	14.8	45.7	11.6
1977	14.5	8.5	1.4	24.4	9.0	23.0	15.4	47.3	6.1
1978	6.8	9.5	0.6	16.9	7.3	26.9	21.6	55.8	5.0
1979	13.0	7.7	2.5	23.2	10.6	30.7	27.9	69.2	15.2
1980	11.3	12.7	3.2	27.2	11.3	33.7	32.1	77.1	11.8
1981	14.4	23.7	2.1	40.1	12.8	40.0	37.9	90.4	9.4
1982	18.7	9.8	1.4	30.0	12.9	33.9	33.3	80.2	10.3
1983	10.4	9.5	1.2	21.1	25.0	53.9	85.0	163.8	11.2
1984	10.9	11.1	1.7	23.7	23.6	67.3	70.8	161.9	w/h
1985	13.8	7.8	3.1	24.8	24.2	71.8	69.1	165.1	10.9
1986	10.8	5.1	2.9	18.8	19.9	78.6	66.0	164.4	12.0
1988	15.5	11.8	3.4	30.7	21.7	79.9	96.1	197.7	19.5
1989	33.9	37.8	14.4	86.1	36.2	70.9	132.8	239.9	19.8
1990	58.0	26.0	8.0	92.0	37.0	69.0	142.0	248.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by industry, 1973-1989.

	Food and kindred products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	77.6	104.8	14.3	196.7	39.1	110.4	53.6	203.1	32.6
1974	73.4	111.7	14.3	199.2	48.8	143.5	76.8	268.9	52.2
1975	75.6	93.9	11.4	180.9	53.2	153.7	87.7	294.2	62.6
1976	102.5	97.6	7.4	207.5	57.7	187.5	100.5	345.9	63.7
1977	67.9	103.6	12.5	183.9	56.2	211.6	89.5	357.1	53.3
1978	67.7	94.4	12.9	175.0	69.4	243.2	99.4	412.0	57.1
1979	57.9	111.1	13.6	182.7	91.0	297.9	115.3	504.2	80.3
1980	61.7	133.0	13.5	208.2	81.6	314.3	123.6	519.4	79.5
1981	53.9	104.8	14.8	173.5	78.3	343.3	157.5	579.1	91.2
1982	47.4	110.9	11.0	169.3	77.1	328.1	116.2	522.1	51.1
1983	37.7	105.1	10.9	153.8	96.1	402.3	151.3	649.6	32.7
1984	50.6	91.8	12.2	154.5	101.3	458.1	155.0	714.4	43.7
1985	66.2	77.4	11.7	155.1	106.3	525.2	201.0	832.1	33.4
1986	61.9	108.2	15.7	185.8	126.0	559.9	246.1	932.1	w/h
1988	100.2	91.0	19.8	211.0	157.8	673.3	328.9	1,160.0	110.6
1989	51.7	183.6	25.2	260.6	137.4	663.5	255.3	1,056.2	82.0
1990	65.0	163.0	21.0	249.0	146.0	693.0	271.0	1,109.0	na

	Textile mill products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	10.3	17.7	1.2	29.2	6.3	23.5	9.0	38.8	2.8
1974	12.7	17.7	1.7	32.0	9.4	31.3	13.3	54.0	2.5
1975	19.7	22.2	1.1	43.0	9.4	29.4	12.0	50.7	w/h
1976	9.2	42.6	1.6	53.3	9.2	41.8	14.3	65.3	8.4
1977	20.7	14.7	1.4	36.7	10.9	46.4	31.0	75.0	6.6
1978	42.7	15.4	1.6	59.7	19.0	51.6	21.9	92.5	w/h
1979	21.9	15.2	2.1	39.2	19.0	60.2	22.5	101.7	10.5
1980	32.5	23.6	3.5	59.5	16.6	59.3	39.9	115.8	13.4
1981	27.2	16.2	4.6	48.0	18.9	60.2	29.4	108.5	18.2
1982	12.2	6.2	3.6	22.0	14.8	41.4	18.3	74.7	7.6
1983	9.4	8.4	0.9	18.7	21.3	54.5	25.4	101.1	5.4
1984	12.8	6.3	1.8	20.9	25.8	68.4	28.0	122.2	5.3
1985	12.2	10.3	2.1	24.7	30.9	82.6	35.4	148.9	3.3
1986	12.3	10.5	2.6	25.5	28.5	94.9	38.2	161.6	w/h
1988	8.0	8.0	2.9	18.9	30.5	98.3	47.6	177.0	10.7
1989	9.7	16.5	3.3	29.5	25.3	109.4	51.3	185.9	5.8
1990	19.0	25.0	2.0	46.0	26.0	115.0	58.0	198.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by industry, 1973-1989.

Lumber and wood products

Year	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	41.5	11.7	9.6	62.7	14.9	18.5	28.2	61.6	7.6
1974	58.4	7.6	15.0	81.1	19.5	14.0	30.8	64.2	12.8
1975	46.4	7.7	21.0	75.1	22.7	19.6	28.3	70.5	17.4
1976	29.5	9.2	12.5	51.1	26.6	21.1	33.6	81.3	25.5
1977	33.9	19.1	6.9	59.9	20.4	19.2	33.9	73.4	15.3
1978	46.9	25.6	12.0	84.5	27.7	19.4	43.7	90.7	26.7
1979	67.5	12.3	13.8	93.6	40.2	25.5	49.7	115.4	28.4
1980	55.8	15.6	10.1	81.5	39.6	32.9	56.4	129.1	37.6
1981	49.2	10.5	18.8	78.5	43.2	26.9	64.6	134.7	29.7
1982	20.0	11.7	1.5	33.2	26.4	23.4	37.3	87.1	16.6
1983	18.0	4.0	3.2	25.2	31.1	27.8	43.9	102.8	9.0
1984	24.1	18.8	5.7	48.5	41.2	30.7	42.4	114.2	13.6
1985	15.2	6.3	13.0	34.5	41.8	35.3	62.0	139.1	10.4
1986	17.8	11.0	4.6	33.3	61.7	42.6	74.7	178.9	14.7
1988	31.6	7.5	5.4	44.5	84.0	57.6	94.5	236.1	24.0
1989	45.9	6.6	7.5	60.0	88.4	38.6	143.0	270.0	19.5
1990	58.0	10.0	37.0	105.0	86.0	37.0	136.0	259.0	na

Paper and allied products

Year	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	166.4	161.0	12.1	339.6	59.2	118.1	43.2	220.5	54.6
1974	270.8	193.2	12.9	476.9	81.2	152.0	55.7	289.0	84.8
1975	323.0	266.0	16.3	605.3	100.9	185.5	57.5	344.0	112.2
1976	180.6	278.6	27.3	486.6	123.3	239.1	67.3	430.3	137.6
1977	134.1	261.7	31.6	427.4	133.5	309.0	86.4	529.0	150.8
1978	123.9	189.0	28.7	341.6	158.4	357.6	105.6	622.0	175.6
1979	207.0	180.6	38.8	426.4	176.6	400.5	121.1	698.2	161.5
1980	197.4	111.2	31.0	339.6	196.2	436.7	129.1	762.1	248.1
1981	168.0	86.5	31.1	285.5	211.8	469.9	148.0	829.7	298.5
1982	190.0	93.7	29.7	313.4	206.7	455.2	134.1	796.0	213.7
1983	122.3	65.9	27.9	216.1	226.5	508.9	183.6	919.1	255.3
1984	151.9	68.2	42.1	262.3	280.7	566.1	213.2	1,060.1	118.4
1985	190.9	106.0	35.6	332.4	313.0	573.4	234.4	1,120.8	107.3
1986	137.1	96.9	37.3	271.3	319.2	565.7	269.7	1,154.6	133.8
1988	233.4	97.2	87.1	417.7	372.4	627.7	343.2	1,343.3	245.6
1989	392.4	261.0	54.9	808.2	388.1	686.8	374.2	1,449.0	264.9
1990	414.0	510.0	152.0	1,075.0	398.0	788.0	421.0	1,607.0	na

Source: U.S. Department of Commerce, Bureau of the Census, Pollution Abatement Costs and Expenditures, Current Industrial Reports, MA-200. (Washington, DC: DOC, annual).

Notes: Data for 1987 not available. w/h=withheld by industry.

Table 12.—U.S. government outlays, by function and superfunction, 1962-1990.

Year	Superfunction						
	National defense	Human resources	Physical resources	Net interest	Others	Undistributed	Total
	billion $						*trillion $*
1962	52	32	9	7	12	-5	0.11
1963	53	34	8	8	14	-6	0.11
1964	55	35	10	8	16	-6	0.12
1965	51	37	11	9	17	-6	0.12
1966	58	42	13	9	17	-7	0.13
1967	71	51	15	10	17	-7	0.16
1968	82	59	16	11	18	-8	0.18
1969	82	66	12	13	18	-8	0.18
1970	82	75	16	14	17	-9	0.20
1971	79	92	18	15	16	-10	0.21
1972	79	107	20	15	19	-10	0.23
1973	77	120	21	17	25	-13	0.25
1974	79	136	25	21	24	-17	0.27
1975	87	173	35	23	27	-14	0.33
1976	90	204	39	27	27	-14	0.37
1977	97	222	41	30	34	-15	0.41
1978	104	242	53	35	40	-16	0.46
1979	116	268	54	43	40	-17	0.50
1980	134	313	66	53	45	-20	0.59
1981	158	362	71	69	47	-28	0.68
1982	185	389	62	85	51	-26	0.75
1983	210	426	58	90	59	-34	0.81
1984	227	432	58	111	55	-32	0.85
1985	253	472	57	129	68	-33	0.95
1986	273	482	59	136	74	-33	0.99
1987	282	502	55	139	63	-36	1.00
1988	290	533	68	152	57	-37	1.06
1989	304	569	82	169	58	-37	1.14
1990	299	619	125	184	61	-37	1.25

continued

Table 12 (continued).—U.S. government outlays, by function and superfunction, 1962-1990.

	Physical resources function					
Year	Energy	Natural resources & environment	Commerce & housing credit	Trans-portation	Community & regional development	Total physical resources
			billion current $			
1962	0.6	2.0	1.4	4.3	0.5	8.8
1963	0.5	2.3	0.1	4.6	0.6	8.0
1964	0.6	2.4	0.4	5.2	0.9	9.5
1965	0.7	2.5	1.2	5.8	1.1	11.3
1966	0.6	2.7	3.2	5.7	1.1	13.4
1967	0.8	2.9	4.0	5.9	1.1	14.7
1968	1.0	3.0	4.3	6.3	1.4	16.0
1969	1.0	2.9	-0.1	6.5	1.6	11.9
1970	1.0	3.1	2.1	7.0	2.4	15.6
1971	1.0	3.9	2.4	8.1	2.9	18.3
1972	1.3	4.2	2.2	8.4	3.4	19.6
1973	1.2	4.8	0.9	9.1	4.6	20.6
1974	1.3	5.7	4.7	9.2	4.2	25.1
1975	2.9	7.3	9.9	10.9	4.3	35.4
1976	4.2	8.2	7.6	13.7	5.4	39.2
1977	5.8	10.0	3.1	14.8	7.0	40.7
1978	8.0	11.0	6.3	15.5	11.8	52.6
1979	9.2	12.1	4.7	17.5	10.5	54.0
1980	10.2	13.9	9.4	21.3	11.3	66.0
1981	15.2	13.6	8.2	23.4	10.6	70.9
1982	13.5	13.0	6.3	20.6	8.3	61.8
1983	9.4	12.7	6.7	21.3	7.6	57.6
1984	7.1	12.6	6.9	23.7	7.7	57.9
1985	5.7	13.4	4.2	25.8	7.7	56.8
1986	4.7	13.6	4.9	28.1	7.2	58.6
1987	4.1	13.4	6.2	26.2	5.1	54.9
1988	2.3	14.6	18.8	27.3	5.3	68.3
1989	3.7	16.2	29.2	27.6	5.4	82.1
1990	2.4	17.1	67.1	29.5	8.5	124.6

continued

Table 12 (continued).—U.S. government outlays, by function and superfunction, 1962-1990.

	Natural resources & environment											
	Water resources		Conservation & land management		Recreational resources		Pollution control & abatement		Other natural resources		Total	
Year	$	'87$	$	'87$	$	'87 $	$	'87 $	$	'87$	$	'87 $
						billion						
1962	1.3	4.8	0.3	1.3	0.2	0.6	0.1	0.3	0.2	0.7	2.0	7.6
1963	1.4	5.3	0.3	1.2	0.2	0.7	0.1	0.3	0.2	0.8	2.3	8.3
1964	1.5	5.3	0.3	1.2	0.2	0.7	0.1	0.4	0.3	0.9	2.4	8.6
1965	1.5	5.5	0.3	1.2	0.2	0.8	0.1	0.5	0.3	1.0	2.5	9.0
1966	1.7	5.9	0.3	1.1	0.2	0.8	0.2	0.5	0.3	1.1	2.7	9.4
1967	1.7	5.6	0.4	1.2	0.3	0.9	0.2	0.6	0.4	1.2	2.9	9.5
1968	1.6	5.3	0.4	1.3	0.3	1.0	0.2	0.8	0.4	1.2	3.0	9.6
1969	1.6	4.9	0.3	0.8	0.4	1.1	0.3	0.9	0.4	1.1	2.9	8.8
1970	1.5	4.4	0.4	1.1	0.4	1.1	0.4	1.1	0.4	0.2	3.1	8.9
1971	1.8	4.9	0.5	1.3	0.5	1.3	0.7	1.9	0.5	1.4	3.9	10.8
1972	1.9	5.1	0.4	1.2	0.5	0.4	0.8	2.0	0.6	0.5	4.2	11.1
1973	2.2	5.5	0.3	0.8	0.5	0.4	1.1	2.8	0.6	0.4	4.8	11.9
1974	2.2	5.1	0.1	0.3	0.6	0.5	2.0	4.7	0.7	0.5	5.7	13.2
1975	2.6	5.5	0.7	1.4	0.8	0.7	2.5	5.3	0.8	0.6	7.3	15.4
1976	2.7	5.4	0.6	1.2	0.9	0.7	3.1	6.0	0.9	0.7	8.2	16.0
1977	3.2	5.8	0.6	1.1	1.0	0.8	4.3	7.7	1.0	0.7	10.0	18.1
1978	3.4	5.8	1.0	1.7	1.4	2.4	4.0	6.7	1.2	1.9	11.0	18.4
1979	3.9	6.0	0.8	1.3	1.5	2.3	4.7	7.3	1.3	2.0	12.1	18.7
1980	4.2	6.0	1.0	1.5	1.7	2.4	5.5	7.8	1.4	2.0	13.9	19.6
1981	4.1	5.3	1.2	1.5	1.6	2.1	5.2	6.7	1.5	1.9	13.6	17.5
1982	3.9	4.7	1.1	1.3	1.4	1.7	5.0	6.0	1.5	0.8	13.0	15.6
1983	3.9	4.5	1.5	1.7	1.5	1.7	4.3	4.9	1.5	0.8	12.7	14.6
1984	4.1	4.5	1.3	1.4	1.6	1.7	4.0	4.5	1.6	1.8	12.6	13.9
1985	4.1	4.4	1.5	1.6	1.6	1.7	4.5	4.7	1.7	0.8	13.4	14.2
1986	4.0	4.2	1.4	1.4	1.5	1.6	4.8	5.0	1.9	0.9	13.6	14.0
1987	3.8	3.8	1.5	1.5	1.6	1.6	4.9	4.9	1.7	0.7	13.4	13.4
1988	4.0	3.9	2.2	2.1	1.7	0.6	4.8	4.7	1.9	0.8	14.6	14.1
1989	4.3	4.0	3.3	3.1	1.8	0.7	4.9	4.5	1.9	0.8	16.2	15.0
1990	4.4	3.9	3.6	3.2	1.9	0.7	5.1	4.6	2.1	0.9	17.1	15.2

Source: Office of Management and Budget, The Budget for Fiscal Year 1992, Historical tables, part seven, pp. 32-40, (Washington, DC: OMB, 1991).

Note: $=Current dollars. '87 $=Constant FY 1987 dollars. Constant FY 1987 dollars applies the Gross Domestic Product deflators.

Table 13.—State and local government expenditures on the environment, 1956-1990.

Year	Natural resources		Parks and recreation		Sewerage		Solid waste management		Total	
	Current	1982	Current	1982	Current	1982	Current	1982	Current	1982
	billion $									
1956	0.91	4.04	0.54	2.42	0.84	3.73	0.49	2.20	2.77	12.38
1957	0.96	4.09	0.61	2.59	0.91	3.86	0.54	2.29	3.05	12.98
1958	1.00	4.16	0.69	2.85	0.93	3.89	0.57	2.38	3.27	13.61
1959	1.08	4.37	0.73	2.96	1.01	4.11	0.60	2.43	3.53	14.34
1960	1.19	4.72	0.77	3.06	1.10	4.38	0.62	2.48	3.82	15.17
1961	1.33	5.12	0.86	3.31	1.10	4.26	0.67	2.59	4.00	15.46
1962	1.37	5.13	0.89	3.32	1.27	4.76	0.69	2.57	4.43	16.60
1963	1.59	5.80	0.98	3.57	1.46	5.34	0.72	2.64	5.00	18.25
1964	1.84	6.55	1.02	3.65	1.52	5.41	0.75	2.69	5.15	18.39
1965	1.86	6.46	1.10	3.83	1.57	5.44	0.79	2.75	5.50	19.11
1966	2.04	6.75	1.19	3.93	1.71	5.65	0.86	2.86	6.10	20.21
1967	2.34	7.33	1.29	4.03	1.64	5.11	0.89	2.78	6.29	19.64
1968	2.47	7.29	1.41	4.17	1.73	5.11	0.98	2.88	6.67	19.68
1969	2.55	7.03	1.65	4.53	1.90	5.22	1.07	2.96	7.17	19.74
1970	2.73	6.97	1.89	4.82	2.17	5.53	1.25	3.18	8.03	20.49
1971	3.08	7.36	2.11	5.03	2.65	6.32	1.44	3.44	9.28	22.14
1972	3.12	7.03	2.32	5.22	3.26	7.34	1.59	3.57	10.29	23.16
1973	3.28	6.86	2.56	5.36	3.60	7.52	1.72	2.46	11.16	23.35
1974	3.66	6.93	2.95	5.59	4.08	7.73	1.92	3.63	12.61	23.88
1975	4.22	7.27	3.46	5.96	5.26	9.06	2.18	3.75	15.12	26.03
1976	4.66	7.52	3.86	6.23	5.94	9.58	2.30	3.71	16.77	27.04
1977	4.05	6.13	4.92	7.44	7.05	10.67	2.37	3.59	18.39	27.83
1978	4.23	5.94	5.27	7.41	7.14	10.05	2.73	3.84	19.36	27.23
1979	4.71	6.06	5.90	7.59	8.80	11.32	2.99	3.85	22.39	28.81
1980	5.51	6.38	6.52	7.56	9.89	11.48	3.32	3.85	25.24	30.71
1981	6.18	6.61	7.06	7.56	11.12	11.91	3.78	4.04	28.14	30.13
1982	6.57	6.57	7.50	7.50	10.81	10.81	4.13	4.13	29.01	29.01
1983	7.08	6.76	8.05	7.69	11.24	10.73	4.36	4.17	30.74	29.36
1984	7.42	6.75	8.34	7.59	11.52	10.48	4.71	4.29	31.99	29.11
1985	8.36	7.27	9.16	7.97	12.19	10.61	5.21	4.54	34.92	30.39
1986	9.07	7.67	10.16	8.59	13.31	11.69	5.84	5.12	38.38	32.44
1987	9.94	8.07	11.02	8.94	15.15	12.30	6.50	5.28	42.61	34.58
1988	10.24	7.95	12.07	9.37	16.33	12.68	7.35	5.71	45.99	35.70
1989	11.09	8.21	12.93	9.57	17.04	12.61	8.73	6.47	49.79	36.87
1990	12.30	8.70	14.25	10.01	18.31	12.96	10.13	7.17	54.99	53.81

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics on Governmental Finances and Employment, GC82(6)-4, (Washington, DC: DOC, 1982).

U.S. Department of Commerce, Bureau of the Census, Governmental Finances, series GF No. 5, (Washington, DC: DOC, annual).

Note: Historical trend data are available from 1902, as reported in Source above.

Table 14.—Risks and cost-effectiveness of selected regulations, by cost per premature death averted.

Regulation*	Year issued	Health or safety	Agency	Baseline mortality risk per million exposed	Cost per premature death averted
					million $
Unvented Space Heater Ban	1980	S	CPSC	1,890	0.1
Aircraft Cabin Fire Protection Std.	1985	S	FAA	5	0.1
Auto Passive Restraint/Seat Belt Std.	1984	S	NHTSA	6,370	0.1
Steering Column Protection Std.**	1967	S	NHTSA	385	0.1
Underground Construction Stds.***	1989	S	OSHA-S	38,700	0.1
Trihalomethane Drinking Water Stds.	1979	H	EPA	420	0.2
Aircraft Seat Cushion Flammability Std.	1984	S	FAA	11	0.4
Alcohol and Drug Control Stds.***	1985	H	FRA	81	0.4
Auto Fuel-System Integrity Std.	1975	S	NHTSA	343	0.4
Stds. for Servicing Auto Wheel Rims***	1984	S	OSHA-S	630	0.4
Aircraft Floor Emergency Lighting Std.	1984	S	FAA	2	0.6
Concrete & Masonry Construct. Std.***	1988	S	OSHA-S	630	0.6
Crane Suspended Pers. Platf'm Std.***	1988	S	OSHA-S	81,000	0.7
Passive Restraints - Truck & Bus (P)	1989	S	NHTSA	6,370	0.7
Side-Impact Stds. for Autos (Dynamic)	1990	S	NHTSA	na	0.8
Children's Sleepwear Flam'lity Ban****	1973	S	CPSC	29	0.8
Auto Side Door Support Stds.	1970	S	NHTSA	2,520	0.8
Low-Alt. Windsh'r Equip. & Train. Std.	1988	S	FAA	na	1.3
Electrical Equip't Stds. (Metal Mines)	1970	S	MSHA	na	1.4
Trenching $ Excavation Stds.***	1989	S	OSHA-S	14,310	1.5
Traffic Alert & Collision Avoidance Sys.	1988	S	FAA	na	1.5
Hazard Communication Std.***	1983	S	OSHA-S	1,800	1.6
Side-Impact - Truck, Buss & MPV (P)	1989	S	NHTSA	na	2.2
Grain Dust Explosion Prev'n Stds***	1987	S	OSHA-S	9,450	2.8
Rear Lap/Shoulder Belts for Autos	1989	S	NHTSA	na	3.2
Radionuclides - Uran. Mines Stds.***	1984	H	EPA	6,300	3.4
Benzene NESHAP (Fugitive Emis'n)	1984	H	EPA	1,470	3.4
Ethylene Dibromide Drinking Water Std.	1991	H	EPA	na	5.7
Benzene NESHAP (Coke By-Prod.)***	1988	H	EPA	na	6.1
Asbestos Occup'l Exposure Limit***	1972	H	OSHA-H	3,015	8.3
Benzene Occup'l Exposure Limit***	1987	H	OSHA-H	39,600	8.9
Electrical Equip. Stds. (Coal Mines)***	1970	S	MSHA	na	9.2
Arsenic Emis'n Stds. - Glass Plants	1986	H	EPA	2,660	13.5
Ethylene Oxide Occup'l Expos. Limit***	1984	H	OSHA-H	1,98	20.5
Arsenic/Copper NESHAP	1986	H	EPA	63,000	23.0
Haz Waste List - Petrol. Refin. Sludge	1990	H	EPA	210	27.6

continued

Table 14 (continued).—Risks and cost-effectiveness of selected regulations, by cost per premature death averted.

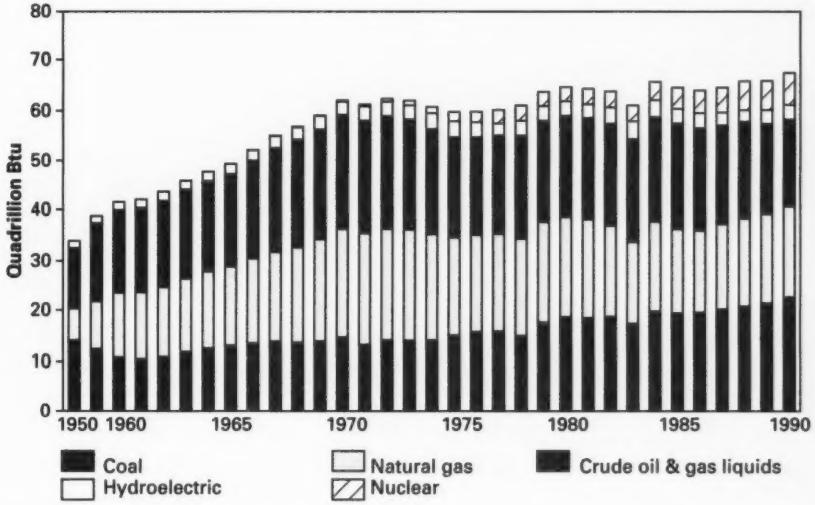
Regulation*	Year issued	Health or safety	Agency	Baseline mortality risk per million exposed	Cost per premature death averted
					million $
Cover/Move Uran. Tail'gs (Inact. Sites)	1983	H	EPA	30,100	32
Benezene NESHAP (Trans. Oper'ns)	1990	H	EPA	na	33
Cover/Move Uran. Tailings (Act. Sites)	1983	H	EPA	30,100	45
Acrylonitrile Occup'l Expos. Limit***	1978	H	OSHA-H	42,300	52
Coke Ovens Occup'l Expos. Limit***	1976	H	OSHA-H	7,200	64
Lockout/Tagout***	1989	S	OSHA-S	4	71
Asbestos Occup'l Expos. Limit***	1986	H	OSHA-H	3,015	74
Arsenic Occup'l Expos. Limit***	1978	H	OSHA-H	14,800	107
Asbestos Ban	1989	H	EPA	na	111
Diethylstilbestrol (DES) Cattlefeed Ban	1979	H	FDA	22	125
Benezene NESHAP (Waste Oper'ns)	1990	H	EPA	na	168
1,2-Dichloropropane Drink. Water Std.	1991	H	EPA	na	653
Haz Waste Land Disposal Ban (1st 3rd)	1988	H	EPA	2	4,190
Municipal Solid Waste Landfill Std. (P)	1988	H	EPA	<1	19,107
Formaldehyde Occup'l Expos. Limit***	1987	H	OSHA-H	31	86,202
Atrazine/Alachlor Drinking Water Std.	1991	H	EPA	na	92,070
Haz Waste List - Wood Preser. Chems.	1990	H	EPA	<1	5,700,000

Source: J.F. Morrall, III,"A review of the record." Regulation, vol. 10, no. 2, p. 30. Updated by the authors and published in Executive Office of the President, The Budget for Fiscal Year 1992.

Notes: *=70-year lifetime exposure assumed unless otherwise specified; **=50-year lifetime exposure; ***=45-year lifetime exposure; ****=12-year lifetime exposure; na=notavailable. Abbreviations—CPSC: Consumer Product Safety Commission; MSHA: Mine Safety and Health Administration; EPA: Environmental Protection Agency; NHTSA: National Highway Traffic Safety Administration; FAA: Federal Aviation Administration; FRA: Federal Railroad Administration; FDA: Food and Drug Administration; OSHA-H: Occupational Safety and Health Administration, Health Standards; OSHA-S: Occupational Safety and Health Administration, Safety Standards. Potential benefits other than avoiding premature death are not included. Other benefits could include avoiding risks that are not life threatening and benefits that are not related to health.

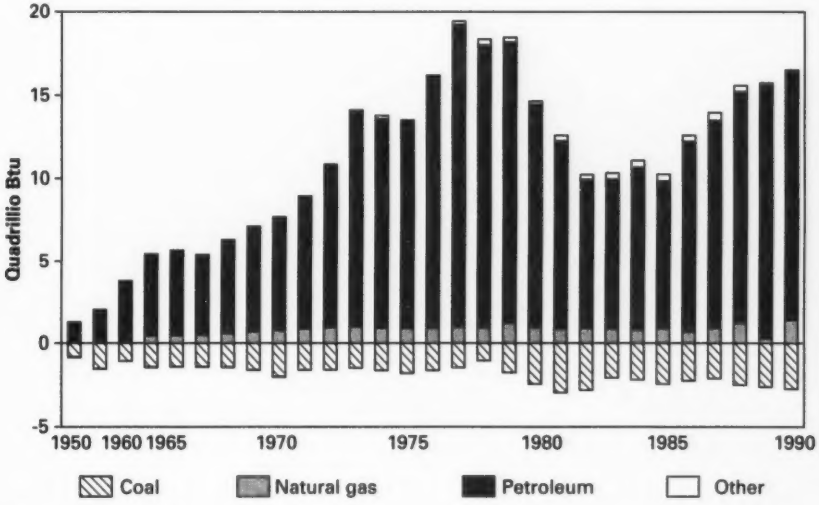
Energy

Figure 7.—U.S. energy production, by source, 1950-1990.



Source: See Table 16.

Figure 8.—Net U.S. imports of energy, 1950-1990.



Source: See Table 22.

Table 15.—Energy equivalents, 1990.

Energy unit		Equivalent
1 Btu of energy	1	match tip
	250	calories (International Steam Table)
	0.25	kilocalories (food calories)
1,000 Btu of energy	2	5-ounce glasses of wine
	250	kilocalories (food calories)
	0.8	peanut butter and jelly sandwiches
1 million Btu of energy	90	pounds of coal
	120	pounds of oven-dried hardwood
	8	gallons of motor gasoline
	10	therms of dry natural gas
	11	gallons of propane
	2	months of the dietary intake of a laborer
1 quadrillion Btu of energy	45	million short tons of coal
	60	million short tons of oven-dried hardwood
	1	trillion cubic feet of dry natural gas
	170	million barrels of crude oil
	470	thousand barrels of crude oil per day for 1 year
	28	days of U.S. petroleum imports
	26	days of U.S. motor gasoline use
	26	hours of world energy use (1989)
1 barrel of crude oil	5.6	thousand cubic feet of dry natural gas
	0.26	short tons (520 pounds) of coal
	1,700	kilowatthours of electricity
1 short ton of coal	3.8	barrels of crude oil
	21	thousand cubic feet of dry natural gas
	6,500	kilowatthours of electricity
1,000 cubic feet of natural gas	0.18	barrels (7.4 gallons) of crude oil
	0.05	short tons (93 pounds) of coal
	300	kilowatthours of electricity
1,000 kilowatthours of electricity	0.59	barrels of crude oil*
	0.15	short tons (310 pounds) of coal*
	3,300	cubic feet of dry natural gas*

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table B-3, p. 306, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: Equivalents are approximate. One quadrillion equals 1,000,000,000,000,000. *=Because of energy losses associated with the generation of electricity, about three times as much fossil fuel is required to generate 1,000 kilowatthours: 1.8 barrels of oil, 0.47 short tons of coal, or 10,000 cubic feet of dry natural gas."

Table 16.—U.S. energy production, by source, 1950-1990.

Year	Coal	Natural gas	Crude oil & NGPL	Hydro-electric	Nuclear	Other	Total
			quadrillion Btu				
1950	14.06	6.23	12.27	1.42	0.00	0.01	33.98
1955	12.37	9.34	15.65	1.36	0.00	<0.01	38.73
1960	10.82	12.66	16.39	1.61	0.01	<0.01	41.49
1961	10.45	13.10	16.76	1.66	0.02	<0.01	41.99
1962	10.90	13.72	17.11	1.82	0.03	<0.01	43.58
1963	11.85	14.51	17.68	1.77	0.04	<0.01	45.85
1964	12.52	15.30	17.96	1.89	0.04	<0.01	47.72
1965	13.06	15.78	18.40	2.06	0.04	<0.01	49.34
1966	13.47	17.01	19.56	2.06	0.06	<0.01	52.17
1967	13.83	17.94	20.83	2.35	0.09	0.01	55.04
1968	13.61	19.07	21.63	2.35	0.14	0.01	56.81
1969	13.86	20.45	21.98	2.65	0.15	0.01	59.10
1970	14.61	21.67	22.91	2.63	0.24	0.01	62.07
1971	13.19	22.28	22.57	2.82	0.41	0.01	61.29
1972	14.09	22.21	22.64	2.86	0.58	0.03	62.42
1973	13.99	22.19	22.06	2.86	0.91	0.04	62.06
1974	14.07	21.21	21.04	3.18	1.27	0.05	60.84
1975	14.99	19.64	20.10	3.15	1.90	0.07	59.86
1976	15.65	19.48	19.59	2.98	2.11	0.08	59.89
1977	15.76	19.57	19.78	2.33	2.70	0.09	60.22
1978	14.91	19.49	20.68	2.94	3.02	0.06	61.10
1979	17.54	20.08	20.39	2.93	2.78	0.09	63.80
1980	18.60	19.91	20.50	2.90	2.74	0.11	64.76
1981	18.38	19.70	20.46	2.76	3.01	0.12	64.42
1982	18.64	18.25	20.50	3.27	3.13	0.10	63.89
1983	17.25	16.53	20.57	3.53	3.20	0.13	61.19
1984	19.72	17.93	21.12	3.35	3.55	0.17	65.81
1985	19.33	16.91	21.23	2.94	4.15	0.21	64.76
1986	19.51	16.47	20.53	3.02	4.47	0.23	64.23
1987	20.14	17.05	19.89	2.59	4.91	0.25	64.82
1988	20.74	17.52	19.54	2.31	5.66	0.23	66.01
1989	21.35	17.78	18.28	2.77	5.68	0.22	66.06
1990	22.61	18.05	17.62	2.92	6.19	0.20	67.59

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 1, p. 7, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: NGPL= Natural gas plant liquids. Other includes electricity produced from geothermal, wood, waste, wind, photovoltaic, and solar thermal sources. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Table 17.—U.S. coal production, by rank and mining method, 1950-1990.

Year	Rank				Mining method	
	Bituminous	Sub-bituminous	Lignite	Anthracite	Underground	Surface
	million metric tons					
1950	468.29	i	i	39.98	381.85	126.42
1955	421.42	i	i	23.77	324.67	120.52
1960	376.87	i	i	17.07	265.37	128.56
1961	365.50	i	i	15.82	253.55	127.77
1962	382.89	i	i	15.32	261.16	137.05
1963	416.25	i	i	16.57	280.24	152.58
1964	441.71	i	i	15.59	297.22	160.07
1965	464.46	i	i	13.48	306.53	171.42
1966	484.23	i	i	11.74	310.75	185.22
1967	501.23	i	i	11.12	319.62	192.73
1968	494.54	i	i	10.40	314.36	190.57
1969	496.29	7.55	4.55	9.50	316.76	201.12
1970	524.67	14.90	7.29	8.82	308.86	246.82
1971	472.86	20.09	7.89	7.92	251.40	257.36
1972	505.06	24.99	9.97	6.45	276.68	269.78
1973	492.98	30.78	12.95	6.19	272.17	270.73
1974	494.94	38.31	14.04	6.00	252.12	301.18
1975	523.81	46.35	17.97	5.63	266.17	327.58
1976	533.65	58.81	23.11	5.65	267.99	353.23
1977	526.96	74.48	25.61	5.32	241.80	390.57
1978	484.36	87.76	31.16	4.57	220.19	387.64
1979	555.34	110.18	38.59	4.39	291.05	417.44
1980	570.29	133.98	42.77	5.49	306.12	446.42
1981	551.44	144.84	45.96	4.92	287.06	460.10
1982	562.49	145.98	47.54	4.16	307.61	452.56
1983	515.73	137.00	52.92	3.71	272.44	436.91
1984	589.09	162.53	57.20	3.77	319.31	493.29
1985	556.92	174.82	65.68	4.26	318.24	483.35
1986	562.55	172.00	69.31	3.90	326.95	480.72
1987	577.42	181.59	71.11	3.27	338.23	495.15
1988	578.78	205.90	79.46	3.18	359.37	524.72
1989	598.47	209.71	78.37	2.99	357.19	532.34
1990	633.02	222.41	81.27	2.81	377.69	561.82

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 82, p. 187, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Note: i=included in bituminous coal. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Table 18.—U.S. petroleum production and imports, 1940-1990.

Year	Production			Imports	Year	Production			Imports
	Crude oil	NGPL	Total			Crude oil	NGPL	Total	
	million barrels per day					*million barrels per day*			
1940	3.71	0.15	3.93	0.12	1966	8.30	1.28	9.58	2.57
1941	3.84	0.22	4.06	0.14	1967	8.81	1.41	10.22	2.54
1942	3.80	0.23	4.03	0.03	1968	9.12	1.51	10.60	2.84
1943	4.12	0.24	4.37	0.38	1969	9.24	1.59	10.83	3.17
1944	4.60	0.27	4.97	0.12	1970	9.64	1.66	11.30	3.42
1945	4.69	0.31	5.00	0.20	1971	9.46	1.69	11.16	3.93
1946	4.75	0.32	5.07	0.24	1972	9.47	1.75	11.18	4.74
1947	5.09	0.36	5.45	0.27	1973	9.21	1.74	10.95	6.26
1948	5.53	0.40	5.94	0.35	1974	8.77	1.69	10.46	6.11
1949	5.05	0.43	5.05	0.65	1975	8.37	1.63	10.01	6.06
1950	5.41	0.50	5.91	0.85	1976	8.15	1.61	9.74	7.31
1951	6.16	0.56	6.72	0.84	1977	8.24	1.62	9.86	8.81
1952	6.27	0.61	6.87	0.95	1978	8.71	1.57	10.27	8.36
1953	6.46	0.65	7.11	1.03	1979	8.55	1.58	10.14	8.46
1954	6.34	0.69	7.03	1.05	1980	8.60	1.58	10.17	6.91
1955	6.81	0.77	7.58	1.25	1981	8.57	1.61	10.18	6.00
1956	7.17	0.80	7.95	1.44	1982	8.65	1.55	10.20	5.11
1957	7.17	0.81	7.98	1.57	1983	8.69	1.56	10.25	5.05
1958	6.71	0.81	7.52	1.70	1984	8.88	1.63	10.51	5.44
1959	7.05	0.88	7.93	1.78	1985	8.97	1.61	10.58	5.07
1960	7.05	0.93	7.96	1.81	1986	8.68	1.55	10.23	6.22
1961	7.18	0.99	8.17	1.92	1987	8.35	1.60	9.94	6.68
1962	7.33	1.02	8.35	2.08	1988	8.14	1.62	9.76	7.40
1963	7.54	1.10	8.64	2.12	1989	7.61	1.55	9.16	8.06
1964	7.64	1.16	8.77	2.26	1990	7.30	1.55	8.85	7.96
1965	7.80	1.21	9.01	2.47					

Source: Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series M 143, 138, (Washington, DC: DOC, 1976).

U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 51, p. 117, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: Crude oil includes lease condensate. NGPL=Natural gas plant liquids. Imports for years 1940-1949 include crude petroleum products only. Previous year data may have been revised. Current-year data are preliminary and may be revised in the future.

Table 19.—U.S. natural gas production, 1900-1990.

Year	Well production *trillion cubic feet*	Year	Well production *trillion cubic feet*	Year	Well production *trillion cubic feet*
1900	0.128	1931	1.722	1962	13.880
1901	0.180	1932	1.594	1963	14.750
1902	0.206	1933	1.597	1964	15.550
1903	0.239	1934	1.816	1965	16.040
1904	0.257	1935	1.969	1966	17.207
1905	0.320	1936	2.225	1967	18.171
1906	0.389	1937	2.473	1968	19.322
1907	0.407	1938	2.358	1969	20.698
1908	0.402	1939	2.538	1970	21.921
1909	0.481	1940	2.734	1971	22.490
1910	0.509	1941	2.894	1972	22.530
1911	0.513	1942	3.146	1973	22.650
1912	0.562	1943	3.516	1974	21.600
1913	0.582	1944	3.815	1975	20.110
1914	0.592	1945	4.042	1976	19.950
1915	0.629	1946	4.153	1977	20.030
1916	0.753	1947	4.582	1978	19.970
1917	0.795	1948	5.148	1979	20.470
1918	0.721	1949	5.420	1980	20.180
1919	0.746	1950	6.282	1981	19.960
1920	0.812	1951	7.457	1982	18.520
1921	0.674	1952	8.013	1983	16.820
1922	0.776	1953	8.397	1984	18.230
1923	1.025	1954	8.743	1985	17.200
1924	1.162	1955	9.405	1986	16.790
1925	1.210	1956	10.082	1987	17.350
1926	1.336	1957	10.680	1988	17.840
1927	1.471	1958	11.030	1989	18.030
1928	1.596	1959	12.046	1990	18.370
1929	1.952	1960	12.771		
1930	1.979	1961	13.250		

Source: Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series M 147, (Washington, DC: DOC, 1976).

U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 74, p. 167, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: Production data are for marketed production which includes extraction loss and transfers to natural gas plant liquids. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Table 20.—U.S. production of electricity, by energy source, 1950-1990.

Year	Coal	Natural gas	Petroleum	Nuclear power	Hydroelectric	Geothermal & other	Total
			billion kilowatthours				
1950	155	45	34	0	96	<1	329
1955	301	95	37	0	113	<1	547
1960	403	158	48	1	146	<1	756
1961	422	169	49	2	152	<1	794
1962	450	184	49	2	169	<1	855
1963	494	202	52	3	166	<1	917
1964	526	220	57	3	177	<1	984
1965	571	222	65	4	194	<1	1,055
1966	613	251	79	6	195	1	1,144
1967	630	265	89	8	222	1	1,214
1968	685	304	104	13	222	1	1,329
1969	706	333	138	14	250	1	1,442
1970	704	373	184	22	248	1	1,532
1971	713	374	220	38	266	1	1,613
1972	771	376	274	54	273	2	1,750
1973	848	341	314	83	272	2	1,861
1974	828	320	301	114	301	3	1,867
1975	853	300	289	173	300	3	1,918
1976	944	295	320	191	284	4	2,038
1977	985	306	358	251	220	4	2,124
1978	976	305	365	276	280	3	2,206
1979	1,075	329	304	255	280	4	2,247
1980	1,162	346	246	251	276	6	2,286
1981	1,203	346	206	273	261	6	2,295
1982	1,192	305	147	283	309	5	2,241
1983	1,259	274	144	294	332	6	2,310
1984	1,342	297	120	328	321	9	2,416
1985	1,402	292	100	384	281	11	2,470
1986	1,386	249	137	414	291	12	2,487
1987	1,464	273	118	455	250	12	2,572
1988	1,541	253	149	527	223	12	2,704
1989	1,554	267	158	529	265	11	2,784
1990	1,557	263	117	577	280	11	2,805

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 90, p. 207, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: Other includes wood, waste, photovoltaic, and solar thermal energy. i=included under hydroelectric. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Table 21.—U.S. nuclear energy production, 1957-1990.

Year	Nuclear generating units	Net generation of electricity	Year	Nuclear generating units	Net generation of electricity
	number	*billion kilowatthours*		*number*	*billion kilowatthours*
1957	1	*	1974	48	114.0
1958	1	0.2	1975	54	172.5
1959	1	0.2	1976	61	191.1
1960	3	0.5	1977	65	250.9
1961	3	1.7	1978	70	276.4
1962	5	2.3	1979	68	255.2
1963	6	3.2	1980	70	251.1
1964	6	3.3	1981	74	272.7
1965	6	3.7	1982	77	282.8
1966	8	5.5	1983	80	293.7
1967	10	7.7	1984	86	327.6
1968	11	12.5	1985	95	383.7
1969	14	13.9	1986	100	414.0
1970	18	21.8	1987	107	455.3
1971	21	38.1	1988	108	527.0
1972	29	54.1	1989	110	529.4
1973	39	83.5	1990	111	576.8

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 102, p. 231, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Note: Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications. *=less than 0.05 billion kilowatthours.

Table 22.—Net U.S. energy imports, by source, 1950-1990.

Year	Coal	Natural gas	Petroleum	Other	Total
			quadrillion Btu		
1950	-0.78	-0.03	1.24	0.03	0.47
1955	-1.46	-0.02	1.98	0.04	0.54
1960	-1.02	0.15	3.57	0.04	2.74
1965	-1.37	0.44	5.01	- 0.02	4.06
1966	-1.35	0.47	5.21	- 0.01	4.32
1967	-1.35	0.50	4.91	- 0.02	4.04
1968	-1.37	0.58	5.73	- 0.02	4.90
1969	-1.53	0.70	6.42	- 0.02	5.56
1970	-1.93	0.77	6.92	- 0.04	5.72
1971	-1.54	0.88	8.07	*	7.41
1972	-1.53	0.97	9.83	0.05	9.32
1973	-1.42	0.98	12.98	0.14	12.68
1974	-1.57	0.91	12.66	0.19	12.19
1975	-1.74	0.90	12.51	0.08	11.75
1976	-1.57	0.92	15.20	0.09	14.65
1977	-1.40	0.98	18.24	0.20	18.02
1978	-1.00	0.94	17.06	0.33	17.32
1979	-1.70	1.24	16.93	0.27	16.75
1980	-2.39	0.96	13.50	0.18	12.25
1981	-2.92	0.86	11.38	0.33	9.65
1982	-2.77	0.90	9.05	0.28	7.46
1983	-2.01	0.89	9.08	0.36	8.31
1984	-2.13	0.79	9.89	0.40	8.96
1985	-2.39	0.90	8.95	0.41	7.87
1986	-2.19	0.69	11.53	0.35	10.38
1987	-2.05	0.94	12.53	0.48	11.90
1988	-2.45	1.22	14.01	0.36	13.15
1989	-2.57	0.28	15.33	0.14	14.18
1990	-2.70	1.41	15.10	0.02	13.83

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table B-3, p. 306, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: Net imports=imports minus exports. Other includes coal coke and small amounts of electricity transmitted across U.S. borders with Canada and Mexico. Sum of components may not equal totals because of independent rounding. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications. *=less than 0.005 quadrillion Btu.

Table 23.—U.S. energy consumption, by end use sector, 1950-1990.

Year	Residential & commercial	Industrial	Transportation	Total
		quadrillion Btu		
1950	8.87	15.71	8.49	33.08
1951	9.30	17.13	9.04	35.47
1952	9.54	16.76	9.00	35.30
1953	9.50	17.65	9.12	36.27
1954	9.78	16.58	8.90	35.27
1955	10.41	18.86	9.55	38.82
1956	10.96	19.55	9.86	40.38
1957	10.98	19.60	9.90	40.48
1958	11.64	18.70	10.00	40.35
1959	12.15	19.64	10.35	42.14
1960	13.04	20.16	10.60	43.80
1961	13.44	20.25	10.77	44.46
1962	14.27	21.04	11.23	46.53
1963	14.71	21.95	11.66	48.32
1964	15.23	23.27	12.00	50.50
1965	16.03	24.22	12.43	52.68
1966	17.06	25.50	13.10	55.66
1967	18.10	25.70	13.75	57.57
1968	19.23	26.90	14.86	61.00
1969	20.59	28.10	15.50	64.19
1970	21.71	28.63	16.09	66.43
1971	22.59	28.57	16.72	67.89
1972	23.69	29.86	17.71	71.26
1973	24.14	31.53	18.60	74.28
1974	23.72	30.69	18.12	72.54
1975	23.90	28.40	18.25	70.55
1976	25.02	30.24	19.10	74.36
1977	25.39	31.08	19.82	76.29
1978	26.09	31.39	20.61	78.09
1979	25.81	32.61	20.47	78.90
1980	25.65	30.61	19.69	75.96
1981	25.24	29.24	19.51	73.99
1982	25.63	26.14	19.07	70.85
1983	25.63	25.75	19.13	70.52
1984	26.50	27.73	19.87	74.10
1985	29.73	27.12	20.10	73.95
1986	26.83	26.64	20.76	74.24
1987	27.62	27.87	21.36	76.84
1988	29.00	29.01	22.19	80.20
1989	29.50	29.45	22.38	81.35
1990	29.22	30.17	22.06	81.44

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 4, p. 13, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Table 24.—U.S. energy consumption, per capita, 1950-1990.

Year	Quantity	Year	Quantity
	million Btu		*million Btu*
1950	219	1971	328
1951	230	1972	340
1952	226	1973	351
1953	228	1974	340
1954	218	1975	327
1955	235	1976	342
1956	240	1977	347
1957	236	1978	352
1958	232	1979	351
1959	238	1980	335
1960	244	1981	322
1961	243	1982	305
1962	250	1983	301
1963	256	1984	313
1964	264	1985	310
1965	272	1986	308
1966	285	1987	316
1967	292	1988	326
1968	306	1989	328
1969	319	1990	327
1970	327		

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 7, p. 23, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Notes: Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Table 25.—U.S. energy consumption, per dollar of GNP, 1950-1990.

Year	Petroleum & natural gas	Other energy	Total	Year	Petroleum & natural gas	Other energy	Total
	thousand Btu per 1982 $				*thousand Btu per 1982 $*		
1950	16.02	11.46	27.48	1971	21.34	5.98	27.32
1951	16.17	10.53	28.70	1972	21.33	5.99	27.32
1952	16.31	9.27	25.58	1973	20.90	6.17	27.07
1953	16.35	8.92	25.27	1974	20.22	6.36	26.58
1954	17.07	7.84	24.90	1975	19.55	6.63	26.18
1955	17.56	8.41	25.97	1976	19.64	6.67	26.31
1956	18.06	8.41	26.47	1977	19.28	6.50	25.79
1957	18.13	7.97	26.10	1978	18.61	6.46	25.07
1958	18.96	7.25	26.21	1979	18.10	6.61	24.71
1959	19.05	6.81	25.87	1980	17.13	6.70	23.83
1960	19.40	6.90	26.30	1981	15.96	6.81	22.77
1961	19.40	6.62	26.02	1982	15.39	6.98	22.38
1962	19.33	6.53	25.86	1983	14.46	7.05	21.51
1963	19.27	6.52	25.80	1984	14.15	7.01	21.16
1964	19.05	6.54	25.59	1985	13.47	6.96	20.43
1965	18.69	6.55	25.24	1986	13.15	6.81	19.97
1966	18.75	6.46	25.20	1987	13.16	6.82	19.98
1967	19.03	6.31	25.35	1988	13.14	6.83	19.96
1968	19.53	6.26	25.79	1989	13.02	6.74	19.76
1969	20.23	6.26	26.49	1990	12.76	6.83	19.59
1970	21.24	6.26	27.49				

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 8, p. 25, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Note: Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Table 26.—World primary energy production, by source, 1974-1989.

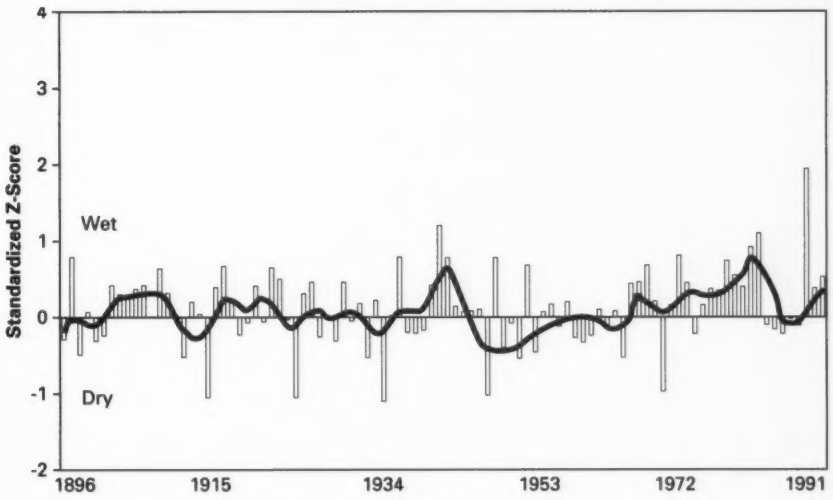
Year	Crude oil & natural gas plant liquids	Natural gas	Coal	Hydro-electric power	Nuclear power	Total
			quadrillion Btu			
1974	122.46	43.76	63.82	14.83	2.87	247.74
1975	117.22	43.90	66.17	15.03	3.85	246.18
1976	127.08	45.68	67.32	15.08	4.52	259.67
1977	132.08	46.88	68.46	15.56	5.40	268.37
1978	132.89	48.24	69.53	16.80	6.41	273.87
1979	138.57	51.57	73.81	17.69	6.67	288.31
1980	133.07	52.79	75.02	18.18	7.56	286.63
1981	125.34	54.25	75.22	18.38	8.51	281.71
1982	119.67	53.74	78.43	18.86	9.50	280.20
1983	119.13	54.06	78.45	19.84	10.71	282.19
1984	122.38	59.12	82.16	20.37	12.98	297.00
1985	120.90	61.37	86.10	20.56	15.35	304.29
1986	126.02	62.56	88.28	20.95	16.31	314.10
1987	127.12	65.58	90.36	21.14	17.76	321.97
1988	132.27	69.04	92.04	21.59	19.28	334.22
1989	134.44	71.11	91.90	21.23	19.66	338.34

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 112, p. 255, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1991).

Note: Total excludes wood, waste, geothermal, wind, photovoltaic, and solar thermal. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

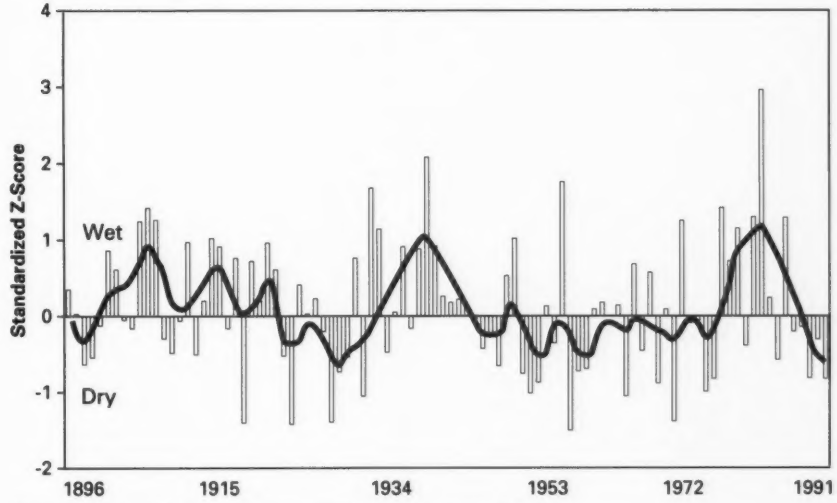
Water

Figure 9a.—Precipitation index for the United States, 1896-1991.



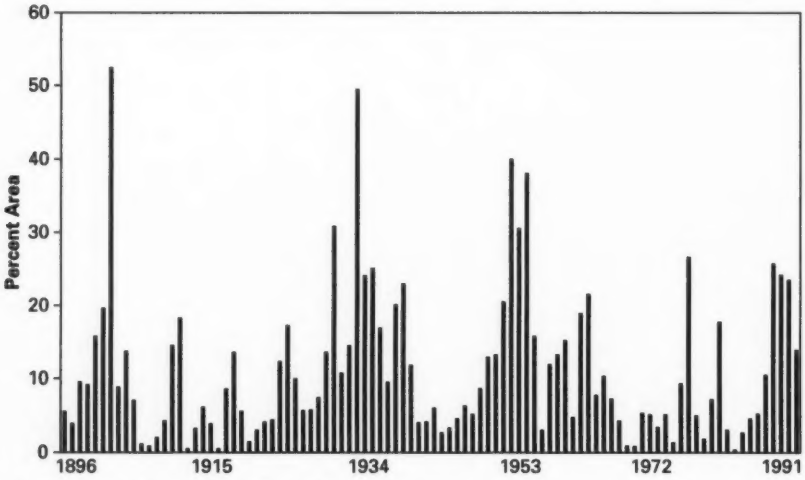
Note: Calculated for the wet season (September through May).
Source: See Table 27.

Figure 9b.—Precipitation index for the Western United States, 1896-1991.



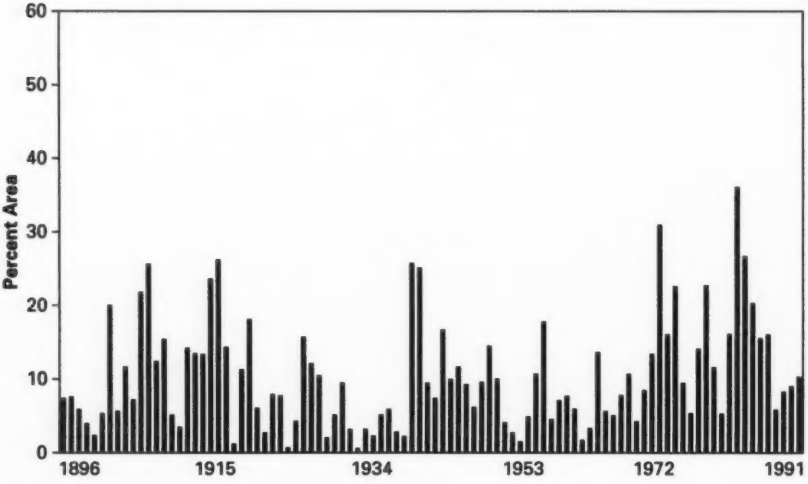
Note: Calculated for the wet season (September through May).
Source: See Table 27.

Figure 10a.—Severe to extreme drought in the conterminous United States, 1896-1991.



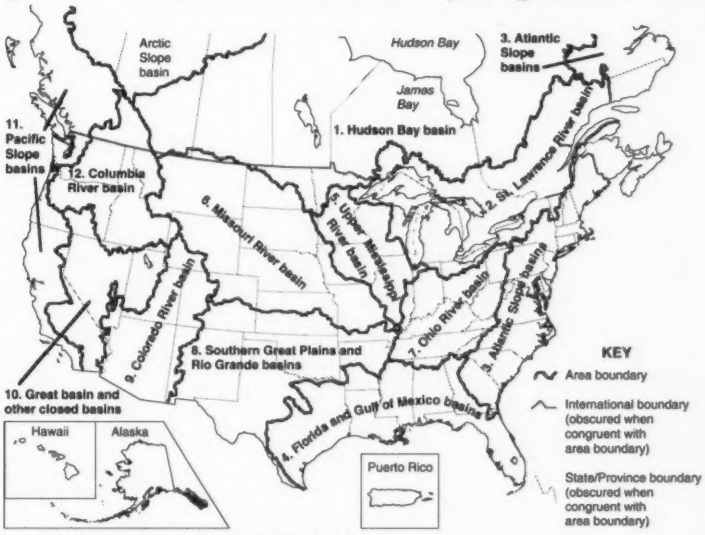
Note: Based on the Palmer Drought Severity Index.
Source: See Table 28.

Figure 10b.—Severe to extreme wetness in the conterminous United States, 1896-1991.



Note: Based on the Palmer Drought Severity Index.
Source: See Table 28.

Figure 11a.—National water conditions hydrologic areas.


Arctic Slope basin
Hudson Bay
James Bay
3. Atlantic Slope basins
1. Hudson Bay basin
11. Pacific Slope basins
12. Columbia River basin
6. Missouri River basin
5. Upper Mississippi River basin
2. St. Lawrence River basin
9. Colorado River basin
7. Ohio River basin
3. Atlantic Slope basins
8. Southern Great Plains and Rio Grande basins
10. Great basin and other closed basins
4. Florida and Gulf of Mexico basins
Hawaii
Alaska
Puerto Rico
KEY
Area boundary
International boundary (obscured when congruent with area boundary)
State/Province boundary (obscured when congruent with area boundary)

Source: U.S. Department of the Interior, Geological Survey.

Figure 11b.—Monthly departure of actual streamflow (1985-1991) from median streamflow (1951-1980).

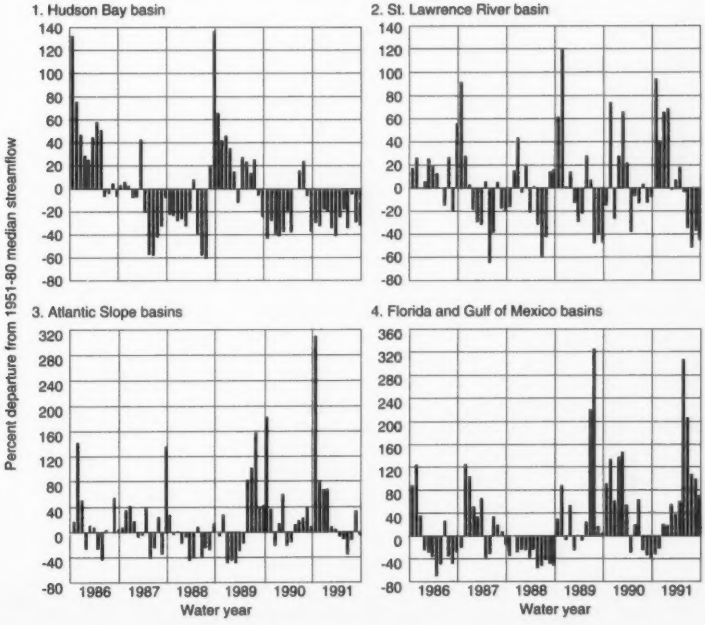
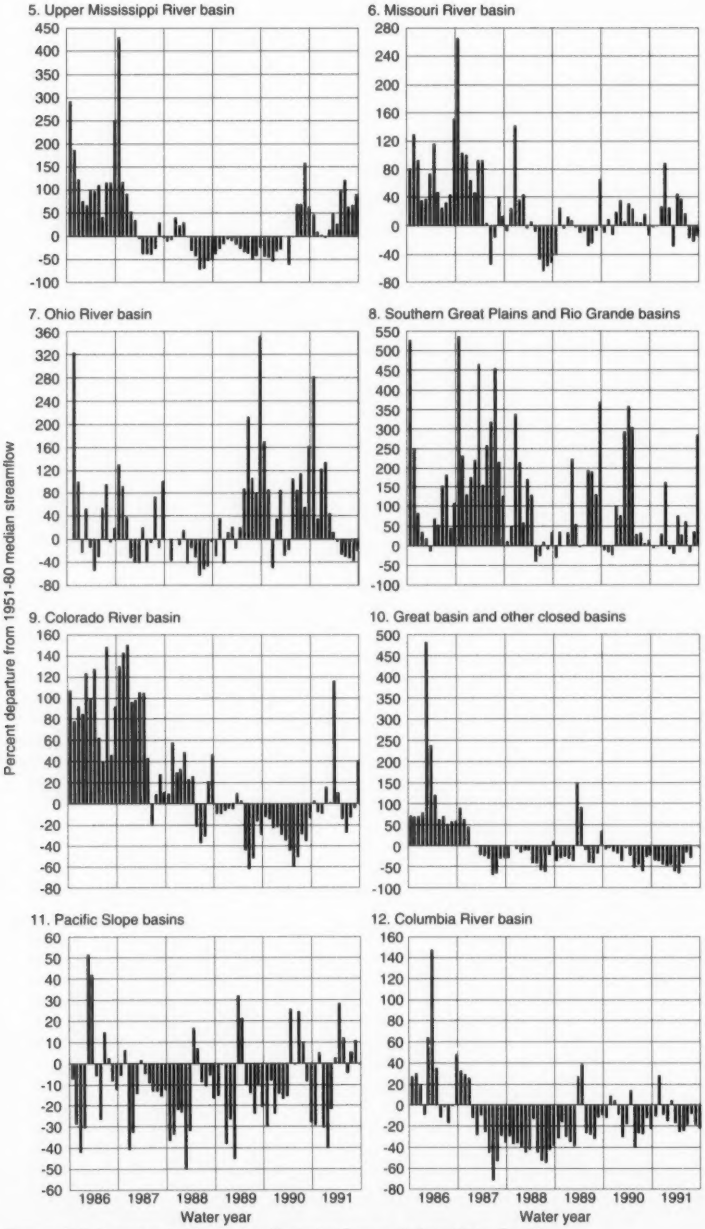
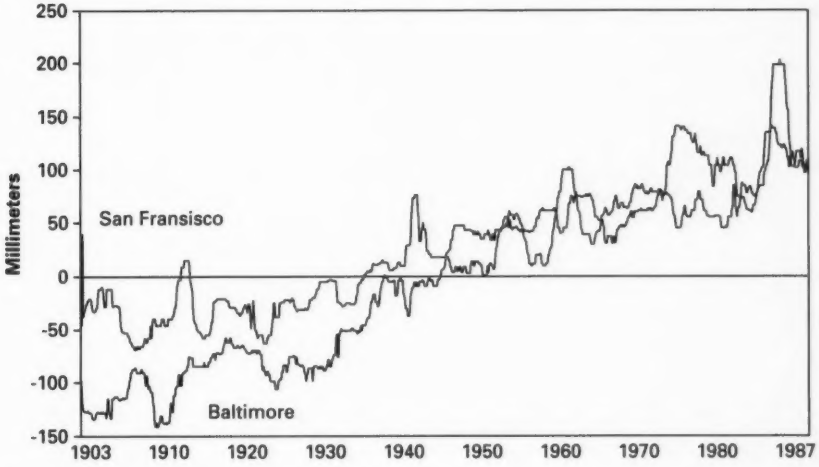


Figure 11b. (continued)—Monthly departure of actual streamflow (1985-1991) from median streamflow (1951-1980).


5. Upper Mississippi River basin
6. Missouri River basin
7. Ohio River basin
8. Southern Great Plains and Rio Grande basins
9. Colorado River basin
10. Great basin and other closed basins
11. Pacific Slope basins
12. Columbia River basin
Percent departure from 1951-80 median streamflow
1986 1987 1988 1989 1990 1991
Water year

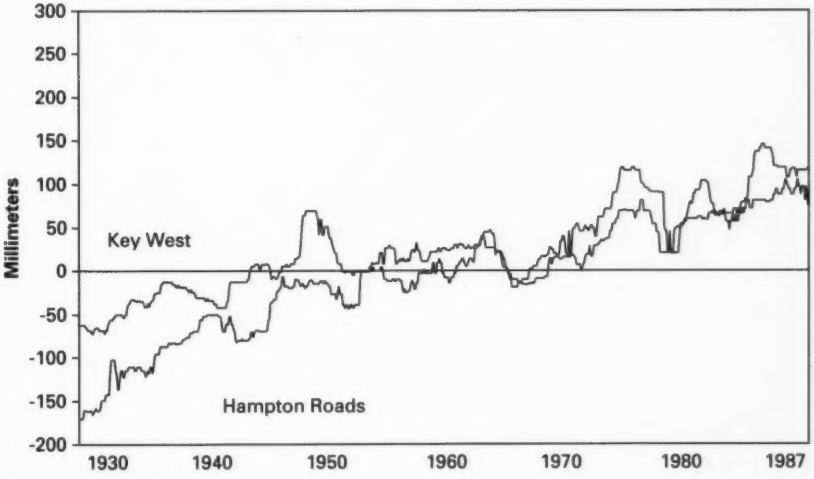
Source: U.S. Department of the Interior, Geological Survey, *National Water Conditions*.

Figure 12a.—Sea level records for selected coastal areas, 1903-1987.



Source: See Table 36.

Figure 12b.—Sea level records for selected coastal areas, 1930-1987.



Source: See Table 36.

Table 27.—Precipitation index for the United States and Western United States, 1896-1991.

Year	Western United States	United States	Year	Western United States	United States	Year	Western United States	United States
	standardized-Z score			*standardized-Z score*			*standardized-Z score*	
1896	-0.29	0.35	1928	-0.26	-0.20	1960	-0.27	-0.72
1897	0.79	0.03	1929	0.01	-1.39	1961	-0.33	-0.69
1898	-0.49	-0.63	1930	-0.31	-0.73	1962	-0.24	0.09
1899	0.07	-0.54	1931	0.46	-0.53	1963	0.10	0.18
1900	-0.31	-0.12	1932	-0.05	0.76	1964	-0.11	0.00
1901	-0.24	0.86	1933	0.18	-1.05	1965	0.08	0.14
1902	0.42	0.61	1934	-0.53	1.68	1966	-0.53	-1.05
1903	0.30	-0.05	1935	0.22	1.14	1967	0.44	0.68
1904	0.28	-0.16	1936	-1.10	-0.47	1968	0.46	-0.45
1905	0.37	1.24	1937	0.02	0.05	1969	0.68	0.57
1906	0.42	1.42	1938	0.79	0.91	1970	0.21	-0.88
1907	0.01	1.26	1939	-0.20	-0.16	1971	-0.97	0.09
1908	0.64	-0.29	1940	-0.21	0.88	1972	0.16	-1.38
1909	0.32	-0.48	1941	-0.17	2.08	1973	0.81	1.25
1910	0.03	-0.06	1942	0.42	0.92	1974	0.45	-0.09
1911	-0.52	0.97	1943	1.20	0.26	1975	-0.22	-0.06
1912	0.20	-0.50	1944	0.78	0.18	1976	0.16	-0.99
1913	0.04	0.20	1945	0.14	0.22	1977	0.37	-0.82
1914	-1.05	1.02	1946	0.07	0.11	1978	0.35	1.42
1915	0.39	0.91	1947	0.08	-0.05	1979	0.74	0.72
1916	0.67	-0.16	1948	0.10	-0.42	1980	0.55	1.15
1917	0.24	0.76	1949	-1.02	-0.26	1981	0.40	-0.38
1918	-0.23	-1.40	1950	0.78	-0.65	1982	0.92	1.30
1919	-0.07	0.72	1951	-0.40	0.53	1983	1.10	2.96
1920	0.41	0.20	1952	-0.08	1.02	1984	-0.10	0.24
1921	-0.06	0.96	1953	-0.54	-0.75	1985	-0.16	-0.57
1922	0.65	0.61	1954	0.68	-1.01	1986	-0.22	1.29
1923	0.50	-0.52	1955	-0.46	-0.87	1987	-0.02	-0.20
1924	-0.03	-1.42	1956	0.07	0.13	1988	-0.11	-0.14
1925	-1.05	0.41	1957	0.17	-0.35	1989	1.94	-0.81
1926	0.31	0.03	1958	-0.12	1.76	1990	0.38	-0.30
1927	0.46	0.23	1959	0.20	-1.50	1991	0.53	-0.82

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, (Ashville, NC: NCDC, 1991).

Notes: To produce the standardized-Z score, the annual precipitation for each climate division in the U.S. is first standardized by gamma distribution, then weighted by area to calculate a regional precipitation index. The regional values are averaged to calculate a national mean standardized precipitation index. A 9-point binomial filter (not shown above,but graphed as a solid line in Figures 9a and 9b) is applied to average out year-to-year fluctuations and show longer-term variations. As indicated above, the Western region(California and Nevada) has been consistently dry (-) since the 1986-87 rainy season.

Table 28.—Severe to extreme drought and wetness in the conterminous United States, 1896-1991.

Year	Severe/ extreme drought	Severe/ extreme wetness	Year	Severe/ extreme drought	Severe/ extreme wetness	Year	Severe/ extreme drought	Severe/ extreme wetness
	% area			*% area*			*% area*	
1896	5.60	7.33	1928	5.81	11.98	1960	13.26	7.01
1897	3.98	7.53	1929	7.47	10.38	1961	15.16	7.61
1898	9.58	5.83	1930	13.58	2.00	1962	4.81	5.86
1899	9.18	3.93	1931	30.81	5.04	1963	18.90	1.67
1900	15.74	2.32	1932	10.77	9.40	1964	21.53	3.28
1901	19.64	5.28	1933	14.49	3.11	1965	7.76	13.50
1902	52.42	19.96	1934	49.47	0.55	1966	10.31	5.58
1903	8.87	5.59	1935	24.08	3.15	1967	7.26	5.00
1904	13.72	11.58	1936	25.08	2.23	1968	4.33	7.73
1905	7.08	7.15	1937	16.88	5.07	1969	0.92	10.58
1906	1.18	21.78	1938	9.53	5.80	1970	0.86	4.19
1907	0.89	25.59	1939	20.11	2.78	1971	5.38	8.41
1908	2.07	12.33	1940	22.96	2.18	1972	5.18	13.30
1909	4.33	15.34	1941	11.84	25.67	1973	3.46	30.83
1910	14.50	5.08	1942	4.08	25.04	1974	5.17	16.00
1911	18.27	3.44	1943	4.20	9.40	1975	1.36	22.52
1912	0.53	14.13	1944	6.05	7.33	1976	9.32	9.39
1913	3.31	13.40	1945	2.73	16.63	1977	26.59	5.31
1914	6.18	13.28	1946	3.37	9.89	1978	5.01	13.99
1915	3.93	23.57	1947	4.63	11.56	1979	1.85	22.64
1916	0.55	26.15	1948	6.33	9.18	1980	7.21	11.49
1917	8.61	14.27	1949	5.23	6.12	1981	17.70	5.22
1918	13.56	1.16	1950	8.66	9.50	1982	3.11	16.05
1919	5.63	11.19	1951	12.93	14.39	1983	0.38	35.99
1920	1.49	18.04	1952	13.23	9.93	1984	2.73	26.61
1921	3.09	5.98	1953	20.50	4.03	1985	4.63	20.23
1922	4.20	2.68	1954	40.00	2.68	1986	5.28	15.47
1923	4.46	7.83	1955	30.54	1.45	1987	10.51	15.98
1924	12.34	7.67	1956	38.03	4.79	1988	25.71	5.78
1925	17.22	0.64	1957	15.76	10.62	1989	24.18	8.22
1926	10.00	4.24	1958	3.09	17.70	1990	23.52	8.93
1927	5.70	15.61	1959	11.94	4.48	1991	13.89	10.21

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, (Ashville, NC: NCDC, 1991).

Notes: The Palmer Drought Severity Index (PDSI) is used to measure long-term drought and wet conditions. The PDSI is calculated for each climate division in the conterminous U.S. This table presents the percent area of the country experiencing severe to extreme long-term drought (PDSI <= -3.00) and wet (PDSI >= +3.00) conditions.

Table 29.—Offstream water use, by source and end use sector, 1900-1985.

Year	Source		End use sector				
	Ground-water	Surface water	Public supply	Rural & domestic livestock	Irrigation	Thermo-electric utility	Other industries
	billion gallons per day						
1900	na	na	3.0	2.0	20.0	5.0	10.0
1910	na	na	5.0	2.2	39.0	7.0	14.0
1920	na	na	6.0	2.4	56.0	9.0	18.0
1930	na	na	8.0	2.9	60.0	18.0	21.0
1940	na	na	10.0	3.1	71.0	23.0	29.0
1945	na	na	12.0	3.4	80.0	31.5	35.0
1950	34.0	150.0	14.0	3.6	89.0	40.0	37.0
1955	47.6	198.0	17.0	3.6	110.0	72.0	39.0
1960	50.4	221.0	21.0	3.6	110.0	100.0	38.0
1965	60.5	253.0	24.0	4.0	120.0	130.0	46.0
1970	69.0	303.0	27.0	4.5	130.0	170.0	47.0
1975	83.0	329.0	29.0	4.9	140.0	200.0	45.0
1980	83.9	361.0	34.0	5.6	150.0	210.0	45.0
1985	73.7	320.0	37.0	7.8	140.0	190.0	31.0

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series J 92-103, (Washington, DC: DOC, 1976).

Solley, W.B., C.F. Merk & R.R. Pierce, Estimated Use of Water in the United States in 1985, U.S. Department of the Interior, Geological Survey Circular 1004, and earlier reports in this series, (Reston, VA: DOI, USGS, 1988).

Note: na=not available.

Table 30.—Designated use support in surface waters of the United States, 1990.

Designated use support	Rivers	Lakes & reservoirs	Estuaries
	miles	*acres*	*square miles*
Fully supporting	407,162	8,173,917	15,004
Threatened	43,214	2,902,809	3,052
Partially supporting	134,472	3,471,633	6,573
Not supporting	62,218	3,940,277	2,064
Not assessed	1,153,000	20,910,000	8,931
Total	1,800,000	39,400,000	35,624

Source: U.S. Environmental Protection Agency, National Water Quality Inventory: 1990 Report to Congress, (Washington, DC: EPA, 1992).

Table 31.—Causes and sources of pollution in surface waters of the United States, 1990.

Causes of pollution	Rivers	Lakes & reservoirs	Estuaries
	impaired miles	*impaired acres*	*impaired square miles*
Siltation	67,059	702,857	312
Nutrients	51,747	1,793,022	3,279
Organic enrichment	47,545	1,072,184	1,876
Pathogens	35,151	129,286	1,781
Metals	28,287	2,672,427	431
Salinity	21,914	243,482	nr
Habitat modification	20,258	nr	nr
Pesticides	20,701	nr	105
Priority organics	nr	247,317	917
Suspended solids	20,819	731,993	467
Flow alteration	15,565	677,413	nr
pH	9,368	192,153	36

Sources of pollution	Rivers	Lakes & reservoirs	Estuaries
	impaired miles	*impaired acres*	*impaired square miles*
Agriculture	103,439	1,996,772	1,074
Municipal	27,994	593,518	2,038
Habitat modification	24,884	1,407,827	307
Resource extraction	24,015	301,398	91
Storm sewers/runoff	18,129	973,077	1,790
Industrial	15,568	318,446	615
Silviculture	15,459	106,502	89
Construction	9,810	106,398	640
Land disposal	7,188	846,892	1,137
Combined sewers	2,836	3,015	359
Unknown	9,266	403,080	189

Source: U.S. Environmental Protection Agency, National Water Quality Inventory: 1990 Report to Congress, (Washington, DC: EPA, 1992).

Notes: nr=not reported. In addition to the above, thermal modifications impair 9,970 river miles. Taste and odor impairments affect 105,288 acres of lakes and reservoirs and noxious aquatic plants impair 711,323 acres. Additional causes of pollution in estuaries are ammonia (50 square miles), oil and grease (36 square miles), and unknown (109 square miles). Estimates of impairment are based on the sums of partially and non-supporting designated uses in Table 30 which represent 9.5% of total U.S. river miles, 8.9% of total U.S. lake acres, and 16.7% of total U.S. estuary square miles.

Table 32.—Trends in stream water quality, 1978-1987.

Water quality indicators	NASQAN* stations analyzed	Flow-adjusted concentrations		
		Upward trend	Downward trend	No trend
		number of stations		
Common ions	393	91	42	260
Calcium	393	50	31	312
Magnesium	392	76	25	291
Sodium	393	55	29	309
Potassium	393	42	54	297
Sulfate	393	34	36	293
Chloride	392	65	32	295
Dissolved solids	388	84	22	282
Nutrients and suspended solids	389	67	61	261
Nitrogen	390	82	24	284
Phosphorus	389	12	69	308
Suspended solids	153	13	19	121
Dissolved oxygen deficit & bacteria	380	25	52	302
Oxygen deficit	316	12	39	265
Fecal coliform	390	24	51	315
Fecal streptococcus	366	20	36	310
Acidity and alkalinity	385	115	12	258
Acidity	387	91	12	284
Total alkalinity	385	82	9	298

Source: Lettenmaier, D.P., E.R. Hooper, C. Wagoner, and K.B. Faris, Trends in stream water quality in the continental United States, 1978-1987, p. 333. Water Resources Research (March 1991).

*Analyses were made on data from the U.S. Geological Survey's National Stream Quality Acounting Network (NASQAN) stations.

Table 33.—Estimated phosphorus loadings to the Great Lakes, 1976-1989.

Year	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
			metric tons		
1976	3,550	6,656	4,802	18,480	12,695
1977	3,661	4,666	3,763	14,576	8,935
1978	5,990	6,245	5,255	19,431	9,547
1979	6,619	7,659	4,881	11,941	8,988
1980	6,412	6,574	5,307	14,855	8,579
1981	3,412	4,091	3,481	10,452	7,437
1982	3,160	4,084	4,689	12,349	8,891
1983	3,407	4,515	3,978	9,880	6,779
1984	3,642	3,611	3,452	12,874	7,948
1985	2,864	3,956	5,758	11,216	7,083
1986	3,059	4,981	4,210	11,118	9,561
1987	1,949	3,298	2,909	8,381	7,640
1988	2,067	2,907	3,165	7,841	6,521
1989	2,323	4,360	3,227	8568	6,723

Source: Great Lakes Water Quality Board, Great Lakes Water Quality Surveillance Subcommittee Reports to the International Joint Commission, United States and Canada, (Windsor, ON, Canada: IJC, biennial).

Note: The 1978 Great Lakes Water Quality Agreement set target loadings for each lake (in metric tons per year): Lake Superior 3,400; Lake Michigan 5,600; Lake Huron 4,360; Lake Erie 11,000; and Lake Ontario 7,000.

Table 34.—Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1990.

Year	DDE	Dieldrin	Mirex	HCB	PCB
			Lake Superior		
		parts per million in whole egg samples, wet weight			
1974	16.72	0.52	1.03	0.25	62.75
1975	23.10	0.38	0.96	0.18	76.24
1976	na	na	na	na	na
1977	11.92	0.38	0.33	0.13	55.22
1978	9.65	0.39	0.27	0.11	41.10
1979	6.83	0.60	0.26	0.14	58.74
1980	3.67	0.34	0.13	0.08	25.58
1981	5.74	0.44	0.14	0.12	33.84
1982	6.29	0.39	0.37	0.08	34.74
1983	na	na	na	na	na
1984	2.94	0.36	0.12	0.05	16.91
1985	3.13	0.32	0.11	0.05	15.89
1986	3.22	0.34	0.11	0.05	14.10
1987	2.55	0.20	0.10	0.04	12.00
1988	2.95	0.34	0.06	0.05	13.50
1989	2.55	0.36	0.07	0.06	13.00
1990	2.65	0.30	0.06	0.03	11.50
			Lake Michigan		
Year	DDE	Dieldrin	Mirex	HCB	PCB
		parts per million in whole egg samples, wet weight			
1976	33.40	0.82	0.36	0.14	120.00
1977	na	na	na	na	na
1978	22.36	0.87	0.21	0.12	90.74
1979	na	na	na	na	na
1980	12.17	0.70	0.10	0.09	57.83
1981	na	na	na	na	na
1982	15.86	0.81	0.09	0.09	65.41
1983	6.47	0.61	0.05	0.05	30.15
1984	7.85	0.53	0.09	0.06	31.47
1985	6.93	0.47	0.11	0.05	31.67
1986	7.48	0.38	0.07	0.07	27.25
1987	8.00	0.59	0.08	0.06	31.00
1988	5.05	0.55	0.04	0.05	19.50
1989	4.85	0.56	0.04	0.05	21.50
1990	8.10	0.55	0.06	0.05	32.50

continued

Table 34 (continued).—Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1990.

Year	DDE	Dieldrin	Lake Huron Mirex	HCB	PCB
	parts per million in whole egg samples, wet weight				
1974	17.41	0.50	1.36	0.38	71.17
1975	14.03	0.36	0.51	0.21	42.67
1976	na	na	na	na	na
1977	16.17	0.54	0.44	0.19	70.28
1978	6.53	0.22	0.21	0.11	32.38
1979	2.30	0.30	0.19	0.10	28.66
1980	2.71	0.24	0.11	0.07	20.41
1981	3.82	0.24	0.26	0.07	25.39
1982	4.43	0.28	0.48	0.08	34.29
1983	2.74	0.22	0.15	0.05	18.28
1984	2.56	0.22	0.34	0.07	19.95
1985	2.77	0.30	0.22	0.06	16.90
1986	2.05	0.21	0.12	0.05	12.00
1987	1.30	0.22	0.09	0.02	8.35
1988	1.40	0.23	0.07	0.04	8.65
1989	1.59	0.20	0.10	0.04	10.10
1990	1.85	0.14	0.11	0.03	11.00

Year	DDE	Dieldrin	Lake Erie Mirex	HCB	PCB
	parts per million in whole egg samples, wet weight				
1974	7.13	0.35	0.64	0.29	72.46
1975	7.41	0.33	0.32	0.19	62.30
1976	na	na	na	na	na
1977	7.49	0.40	0.45	0.19	68.70
1978	4.29	0.24	0.20	0.09	44.43
1979	3.10	0.25	0.17	0.11	48.44
1980	3.00	0.21	0.20	0.09	45.94
1981	3.90	0.22	0.25	0.09	56.49
1982	5.04	0.30	0.34	0.08	59.26
1983	2.36	0.20	0.17	0.05	37.34
1984	3.23	0.33	0.22	0.06	46.20
1985	2.83	0.19	0.14	0.06	38.41
1986	2.77	0.23	0.14	0.06	33.35
1987	1.70	0.14	0.11	0.04	22.00
1988	2.05	0.18	0.11	0.05	27.50
1989	2.65	0.17	0.18	0.05	54.50
1990	2.05	0.10	0.11	0.03	30.00

continued

Table 34 (continued).—Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1990.

Year	Lake Ontario				
	DDE	Dieldrin	Mirex	HCB	PCB
	parts per million in whole egg samples, wet weight				
1974	22.35	0.46	7.02	0.58	155.00
1975	22.80	0.29	4.70	0.33	144.80
1976	na	na	na	na	na
1977	14.88	0.39	2.48	0.42	103.31
1978	10.68	0.26	1.57	0.32	72.65
1979	8.94	0.21	1.89	0.21	69.60
1980	7.65	0.19	1.65	0.18	56.59
1981	11.00	0.28	2.67	0.24	78.90
1982	10.11	0.28	3.09	0.16	62.97
1983	4.78	0.18	1.43	0.08	42.59
1984	6.26	0.21	1.87	0.12	51.11
1985	6.02	0.15	1.47	0.07	35.58
1986	4.35	0.16	1.09	0.07	27.25
1987	2.60	0.13	0.68	0.04	16.50
1988	4.25	0.15	0.82	0.07	23.50
1989	5.25	0.22	1.15	0.07	32.50
1990	18.35	0.10	0.37	0.04	18.50

Source: Environment Canada, Canadian Wildlife Service, Canada Centre for Inland Waters, Organochlorine Contaminant Concentrations in Herring Gull Eggs from Great Lakes Colonies, (Burlington, ON).

Notes: DDE=Metabolite of dichloro-diphenyl-trichloroethane(DDT). HCB=Hexachlorobenzene. PCB=Polychlorinated biphenyl. na=not available.

Table 35.—Shellfish bed closures, by region, 1966-1990.

Year	Northeast	Southeast	Gulf of Mexico	Pacific
		thousand prohibited acres		
1966	443.1	790.0	523.7	3.4
1971	710.4	1,702.4	592.1	317.4
1974	710.8	1,896.6	829.1	316.8
1980	781.8	877.9	889.1	317.5
1985	709.1	612.0	1,649.0	157.0
1990	1,020.0	630.0	2,405.0	183.0

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Ocean Assessments Division, Strategic Assessment Branch, Trends in Harvest-Limited Shellfish Areas (Rockville, MD: Data compiled from the National Estuarine Inventory database).

Table 36.—Sea level trends for selected coastal areas in the United States, 1930-1980.

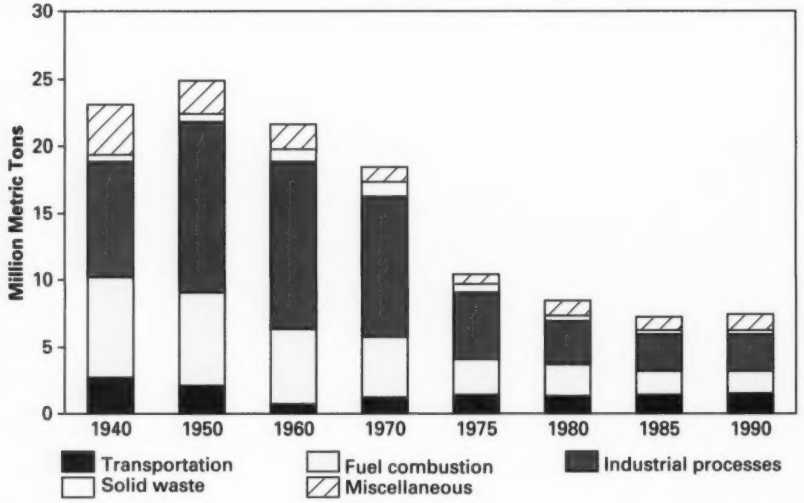
Coast and Station	Latitude	Trend*
	degrees North	*millimeters per year*
Atlantic Coast		
Key West, FL	24.5	2.4
Miami, FL	25.8	2.8
Mayport, FL	30.5	2.6
Charleston, SC	32.8	3.2
Portsmouth, VA	36.8	2.5
Hampton Roads, VA	37.0	2.9
Washington, DC	38.8	1.9
Annapolis, MD	39.0	2.5
Baltimore, MD	39.2	2.2
Atlantic City, NJ	39.3	2.2
Philadelphia, PA	40.0	1.3
New York, NY	40.7	2.0
Willets Point, NY	40.8	1.3
Newport, RI	41.5	1.1
Boston, MA	42.3	0.6
Portland, ME	43.7	1.8
Pacific Coast		
San Diego, CA	32.4	0.7
La Jolla, CA	32.5	2.3
Los Angeles, CA	33.4	1.1
San Francisco, CA	37.5	1.6
Seattle, WA	47.4	3.2
Friday Harbor, WA	48.3	1.7
Honolulu, HI	21.2	2.0

Source: Douglas, B.C., Global sea level rise, Journal of Geophysical Research, 96(C4): 6981-6992, (April 1991).

*Corrected for postglacial rebound.

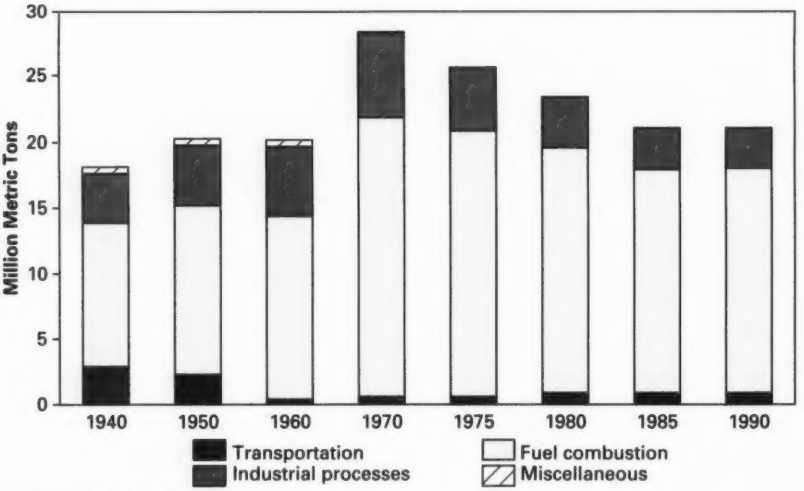
Air Quality

Figure 13a.—U.S. emissions of particulates, by source, 1940-1990.



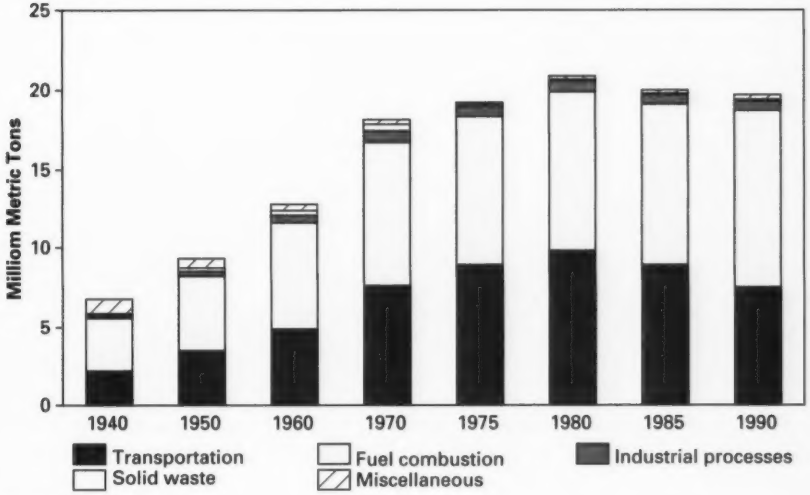
Source: See Table 37.

Figure 13b.—U.S. emissions of sulfur oxides, by source, 1940-1990.



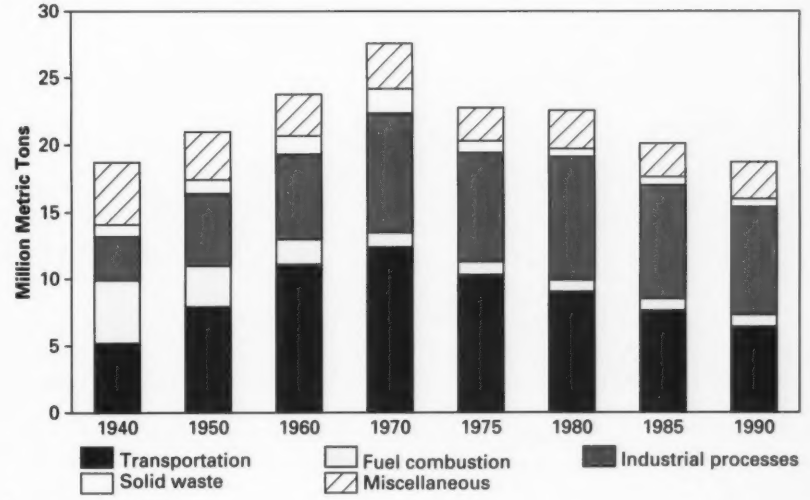
Source: See Table 37.

Figure 13c.—U.S. emissions of nitrogen oxides, by source, 1940-1990.



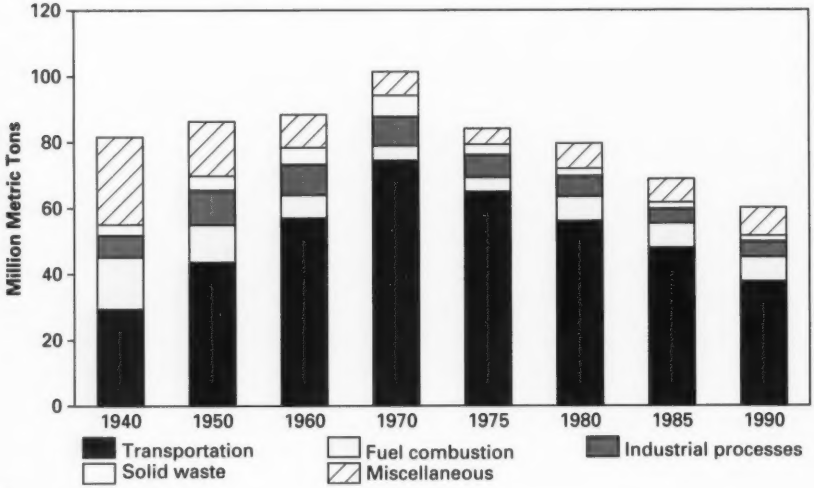
Source: See Table 37.

Figure 13d.—U.S. emissions of volatile organic compounds, by source, 1940-1990.



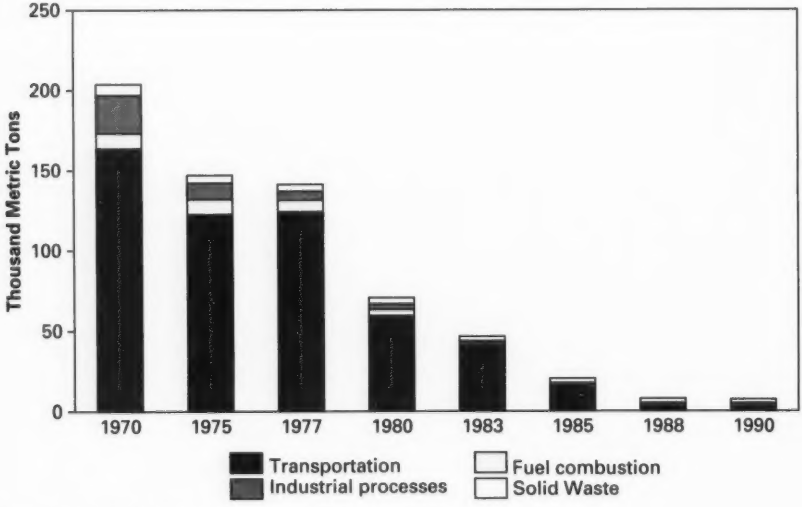
Source: See Table 37.

Figure 13e.—U.S. emissions of carbon monoxide, by source, 1940-1990.



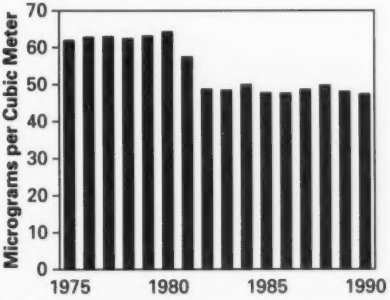
Source: See Table 37.

Figure 13f.—U.S. emissions of lead, by source, 1970-1990.



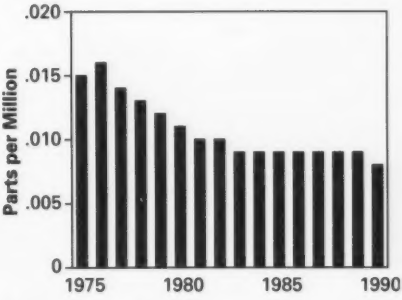
Source: See Table 37.

Figure 14a.—National ambient concentrations of particulates, 1975-1990.



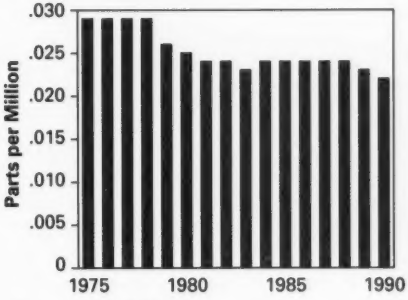
Source: See Table 38.

Figure 14b.—National ambient concentrations of sulfur dioxide, 1975-1990.



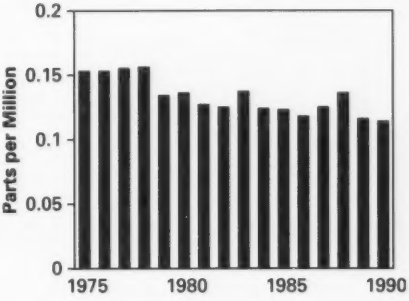
Source: See Table 38.

Figure 14c.—National ambient concentrations of nitrogen dioxide, 1975-1990.



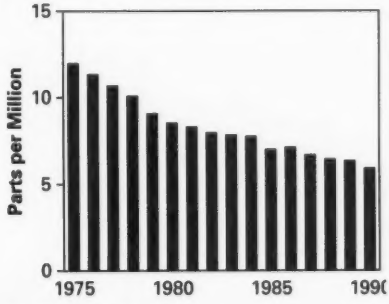
Source: See Table 38.

Figure 14d.—National ambient concentrations of ozone, 1975-1990.



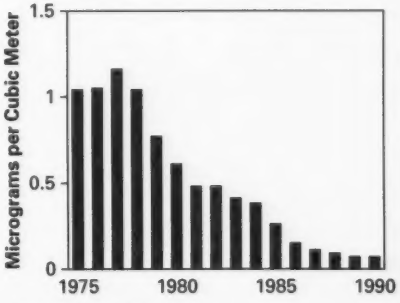
Source: See Table 38.

Figure 14e.—National ambient concentrations of carbon monoxide, 1975-1990.



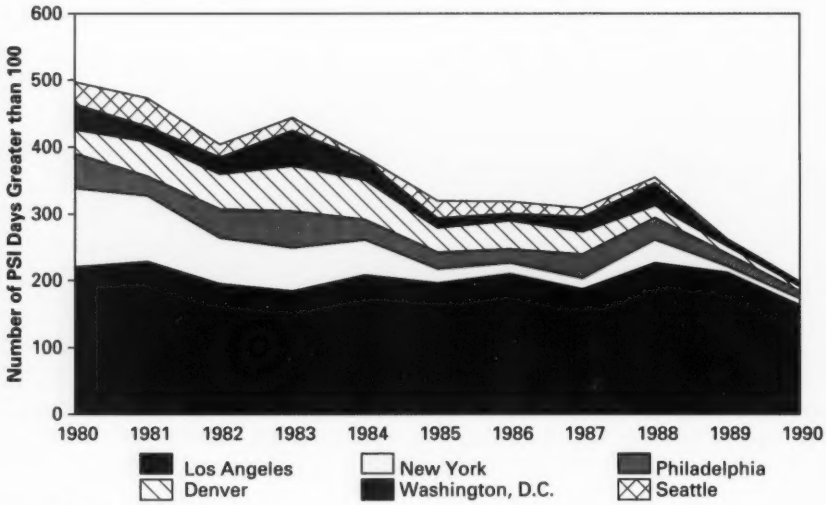
Source: See Table 38.

Figure 14f.—National ambient concentrations of lead, 1975-1990.



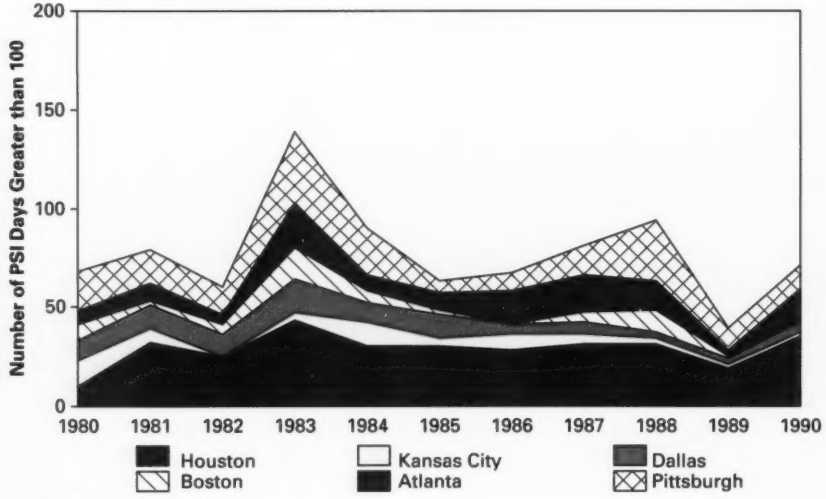
Source: See Table 38.

Figure 15a.—Air quality trends in major urban areas, 1980-1990.



Source: See Table 39.

Figure 15b.—Air quality trends in major urban areas, 1980-1990.



Source: See Table 39.

Table 37.—U.S. emissions of six major air pollutants, by source, 1940-1990.

Year	Sulfur oxides					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1940	2.9	11.0	3.7	0.0	0.5	17.6
1950	2.3	12.9	4.6	0.0	0.5	19.8
1960	0.4	14.0	5.3	0.0	0.5	19.7
1970	0.6	21.3	6.4	0.0	0.1	28.3
1975	0.6	20.3	4.7	0.0	0.0	25.6
1976	0.7	20.9	4.6	0.0	0.0	26.2
1977	0.8	21.5	4.7	0.0	0.0	26.9
1978	0.8	19.9	4.3	0.0	0.0	25.0
1979	0.9	19.5	4.4	0.0	0.0	24.8
1980	0.9	18.7	3.8	0.0	0.0	23.4
1981	0.9	17.8	3.8	0.0	0.0	22.5
1982	0.8	17.3	3.1	0.0	0.0	21.2
1983	0.8	16.7	3.1	0.0	0.0	20.6
1984	0.8	17.4	3.2	0.0	0.0	21.5
1985	0.9	17.0	3.2	0.0	0.0	21.1
1986	0.9	16.9	3.2	0.0	0.0	20.9
1987	0.9	16.6	3.0	0.0	0.0	20.5
1988	0.9	16.6	3.1	0.0	0.0	20.6
1989	1.0	16.8	3.0	0.0	0.0	20.8
1990	0.9	17.1	3.1	0.0	0.0	21.2

Year	Nitrogen oxides					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1940	2.2	3.4	0.2	0.1	0.9	6.8
1950	3.5	4.7	0.3	0.2	0.6	9.3
1960	4.9	6.7	0.5	0.3	0.4	12.8
1970	7.6	9.1	0.7	0.4	0.3	18.1
1975	8.9	9.4	0.7	0.1	0.1	19.2
1976	9.3	10.0	0.7	0.1	0.2	20.3
1977	9.5	10.4	0.7	0.1	0.2	20.9
1978	10.3	10.3	0.7	0.1	0.2	21.7
1979	10.1	10.5	0.7	0.1	0.2	21.6
1980	9.8	10.1	0.7	0.1	0.2	20.9
1981	9.9	10.0	0.6	0.1	0.2	20.9
1982	9.4	9.8	0.5	0.1	0.1	20.0
1983	8.9	9.6	0.5	0.1	0.2	19.4
1984	8.8	10.2	0.6	0.1	0.2	19.8
1985	8.9	10.2	0.6	0.1	0.2	19.9
1986	8.3	10.0	0.6	0.1	0.2	19.1
1987	8.1	10.5	0.6	0.1	0.2	19.4
1988	8.1	10.9	0.6	0.1	0.3	20.0
1989	7.9	11.1	0.6	0.1	0.2	19.8
1990	7.5	11.2	0.6	0.1	0.3	19.6

continued

Table 37 (continued).—U.S. emissions of six major air pollutants, by source, 1940-1990.

Year	Reactive volatile organic compounds					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1940	5.2	4.7	3.3	0.9	4.6	18.6
1950	7.9	3.1	5.4	1.0	3.6	21.0
1960	11.1	1.9	6.3	1.4	3.1	23.8
1970	12.4	1.1	8.9	1.8	3.3	27.5
1975	10.3	1.0	8.1	0.9	2.5	22.8
1976	10.4	1.2	8.7	0.8	2.9	24.0
1977	10.0	1.4	9.0	0.8	2.8	24.2
1978	8.6	0.8	9.9	0.8	2.7	22.8
1979	8.0	0.9	9.9	0.7	2.9	22.4
1980	9.0	0.9	9.2	0.6	2.9	22.7
1981	8.9	1.0	8.3	0.7	2.4	21.3
1982	8.3	1.0	7.5	0.6	2.1	19.6
1983	8.2	1.0	7.9	0.6	2.7	20.4
1984	8.1	1.0	8.9	0.6	2.6	21.2
1985	7.6	0.9	8.5	0.6	2.5	20.1
1986	7.2	0.9	8.0	0.6	2.2	19.0
1987	7.1	0.9	8.3	0.6	2.4	19.3
1988	6.9	0.9	8.1	0.6	2.9	19.4
1989	6.4	0.9	8.1	0.6	2.5	18.5
1990	6.4	0.9	8.1	0.6	2.7	18.7

Year	Total suspended particulates					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1940	2.7	7.5	8.7	0.5	3.7	23.1
1950	2.1	7.0	12.7	0.6	2.5	24.9
1960	0.7	5.7	12.5	0.9	1.8	21.6
1970	1.2	4.6	10.5	1.1	1.1	18.5
1975	1.4	2.7	5.0	0.6	0.7	10.6
1976	1.4	2.5	4.4	0.4	1.0	9.7
1977	1.4	2.5	4.0	0.4	0.8	9.1
1978	1.4	2.5	4.0	0.4	0.8	9.1
1979	1.4	2.5	3.8	0.4	0.9	8.9
1980	1.3	2.4	3.3	0.4	1.1	8.5
1981	1.3	2.3	3.0	0.4	0.9	8.0
1982	1.3	2.2	2.6	0.3	0.7	7.1
1983	1.3	2.0	2.4	0.3	1.1	7.1
1984	1.3	2.1	2.8	0.3	0.9	7.4
1985	1.4	1.8	2.8	0.3	1.0	7.2
1986	1.4	1.8	2.5	0.3	0.8	6.7
1987	1.4	1.8	2.5	0.3	0.9	6.9
1988	1.5	1.7	2.7	0.3	1.3	7.5
1989	1.5	1.8	2.7	0.3	0.9	7.2
1990	1.5	1.7	2.8	0.3	1.2	7.5

continued

Table 37 (continued).—U.S. emissions of six major air pollutants, by source, 1940-1990.

Year	Carbon monoxide					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1940	29.3	15.9	6.6	3.3	26.5	81.6
1950	43.6	11.4	10.5	4.3	16.5	86.3
1960	57.0	7.0	9.3	5.1	10.0	88.4
1970	74.4	4.5	8.9	6.4	7.2	101.4
1975	65.0	4.3	6.9	3.1	4.8	84.1
1976	64.3	4.7	7.1	2.7	7.1	85.9
1977	61.0	5.1	7.3	2.6	5.8	81.8
1978	63.1	5.9	7.2	2.5	5.7	84.4
1979	59.1	6.7	7.1	2.3	6.5	81.7
1980	56.1	7.4	6.3	2.2	7.6	79.6
1981	55.4	7.7	5.9	2.1	6.4	77.5
1982	52.9	8.2	4.4	2.0	4.9	72.5
1983	52.4	8.2	4.3	1.9	7.8	74.5
1984	50.6	8.3	4.7	1.9	6.4	71.9
1985	47.9	7.5	4.4	1.9	7.1	68.7
1986	44.6	7.5	4.2	1.8	5.1	63.2
1987	43.3	7.6	4.3	1.8	6.4	63.4
1988	41.2	7.6	4.6	1.7	9.5	64.7
1989	40.0	7.8	4.6	1.7	6.3	60.4
1990	37.6	7.5	4.7	1.7	8.6	60.1

Year	Lead					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	thousand metric tons					
1970	163.6	9.6	23.9	6.7	0.0	203.8
1975	122.6	9.3	10.3	4.8	0.0	147.0
1976	132.4	8.3	8.1	4.3	0.0	153.1
1977	124.2	7.2	5.7	4.1	0.0	141.2
1978	112.4	6.1	5.4	4.0	0.0	127.9
1979	94.6	4.9	5.2	4.0	0.0	108.7
1980	59.4	3.9	3.6	3.7	0.0	70.6
1981	46.5	2.8	3.0	3.7	0.0	56.0
1982	47.0	1.7	2.7	3.1	0.0	54.5
1983	40.8	0.6	2.4	2.7	0.0	46.6
1984	34.7	0.5	2.3	2.7	0.0	40.2
1985	14.7	0.5	2.3	2.6	0.0	20.1
1986	3.5	0.5	1.9	2.6	0.0	8.4
1987	3.0	0.5	1.9	2.6	0.0	8.0
1988	2.6	0.5	2.0	2.5	0.0	7.6
1989	2.2	0.5	2.3	2.3	0.0	7.2
1990	2.2	0.5	2.2	2.2	0.0	7.1

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1990, EPA-450/4-91-023, (Research Triangle Park, NC: EPA, November 1991).

Table 38.—National ambient concentrations of criteria air pollutants, 1975-1990.

Year	Sulfur dioxide	Carbon monoxide	Ozone	Nitrogen dioxide	Particulate (TSP)	Lead
		ppm			*µg/m3*	*µg/m3*
1975	0.015	11.96	0.153	0.029	61.9	1.04
1976	0.016	11.32	0.153	0.029	62.8	1.05
1977	0.014	10.66	0.155	0.029	62.9	1.16
1978	0.013	10.07	0.156	0.029	62.4	1.04
1979	0.012	9.07	0.134	0.026	63.1	0.77
1980	0.011	8.52	0.136	0.025	64.2	0.61
1981	0.010	8.29	0.127	0.024	57.4	0.48
1982	0.010	7.95	0.125	0.024	48.7	0.48
1983	0.009	7.82	0.137	0.023	48.4	0.41
1984	0.009	7.74	0.124	0.024	49.9	0.38
1985	0.009	6.99	0.123	0.024	47.7	0.26
1986	0.009	7.11	0.118	0.024	47.6	0.15
1987	0.009	6.67	0.125	0.024	48.6	0.11
1988	0.009	6.42	0.136	0.024	49.7	0.09
1989	0.009	6.32	0.116	0.023	48.0	0.07
1990	0.008	5.89	0.114	0.022	47.3	0.07

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1990, EPA-450/4-91-023, (Research Triangle Park, NC: EPA, November 1991).

Notes: ppm=parts per million. µg/m3=micrograms per cubic meter. TSP=total suspended particulates. Sulfur dioxide and nitrogen dioxide records are arithmetic means. Carbon monoxide and ozone records are second maximum readings over 8- and 24-hour periods, respectively. TSP records are geometric means. Lead records are maximum quarterly recordings. Data represent composite averages from all sites in the nationwide monitoring network.

Table 39.—Air quality trends in major urban areas, 1980-1990.

PMSA	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	number of PSI days greater than 100										
Atlanta	7	9	5	23	8	9	17	19	15	3	16
Boston	8	2	5	16	6	2	0	5	11	1	1
Chicago	na	3	31	14	8	4	5	9	18	2	3
Dallas	10	12	11	17	10	12	5	6	3	3	5
Denver	35	51	52	67	59	37	43	34	18	11	7
Detroit	na	18	19	18	7	2	6	9	17	12	3
Houston	10	32	25	43	30	30	28	31	31	19	35
Kansas City	13	7	0	4	12	4	8	5	3	2	2
Los Angeles	220	228	195	184	208	196	210	187	226	212	163
New York	119	100	69	65	53	21	16	16	35	9	10
Philadelphia	52	29	44	56	31	25	21	36	34	19	11
Pittsburgh	20	17	14	36	24	6	9	15	31	11	12
San Francisco	2	1	2	4	2	5	4	1	1	0	1
Seattle	33	42	19	19	4	26	18	13	8	4	2
Washington	38	23	25	53	30	15	11	23	34	7	5
Total	567	576	488	619	492	396	400	409	484	315	276

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1990, EPA-450/4-91-023, (Research Triangle Park, NC: EPA, November 1991).

Notes: PMSA=Primary Metropolitan Statistical Area. PSI=Pollutant Standards Index. The PSI index integrates information from many pollutants across an entire monitoring network into a single number which represents the worst daily air quality experienced in the urban area. Only carbon monoxide and ozone monitoring sites with adequate historical data are included in the PSI trend analysis above, except for Pittsburgh, where sulfur dioxide contributed a significant number of days in the PSI high range. PSI index ranges and health effect descriptor words are as follows: 0 to 50 (good); 51 to 100 (moderate); 101 to 199 (unhealthful; 200 to 299 (very unhealthful); and 300 and above (hazardous). The table above shows the number of days when the PSI was greater than 100 (=unhealthy or worse days).

Table 40.—Wet deposition of cations and anions in the Eastern and Western United States, 1985-1990.

Year	Eastern United States					
	Hydrogen ion	Sulfate ion	Nitrate ion	Ammonium ion	Calcium ion	Precip-itation
	kilograms per hectare					*cm*
1985	0.396	21.33	13.08	2.36	1.55	107.2
1986	0.387	21.57	13.11	2.34	1.29	102.7
1987	0.375	20.34	12.79	2.44	1.29	100.9
1988	0.345	19.64	12.05	1.81	1.50	65.6
1989	0.379	21.45	14.07	3.09	1.44	110.0
1990	0.406	22.06	14.18	3.17	1.43	122.7

Year	Western United States					
	Hydrogen ion	Sulfate ion	Nitrate ion	Ammonium ion	Calcium ion	Precip-itation
	kilograms per hectare					*cm*
1985	0.055	5.25	4.09	0.96	1.23	61.5
1986	0.054	5.51	4.47	1.07	1.18	72.0
1987	0.056	5.26	4.68	1.28	1.06	62.1
1988	0.050	4.72	3.83	0.70	1.16	56.1
1989	0.039	4.73	4.44	1.35	1.18	56.0
1990	0.049	5.16	4.90	1.57	1.18	67.0

Source: Data are from the National Trends Network of the National Atmospheric Deposition Program (NADP/NTN), 1991.

Note: Data are compiled from 79 sites in the Eastern United States and 44 sites in the Western United States.

Table 41.—Global surface temperature anomalies, 1867-1990.

Year	Annual temperature anomalies *degrees Celsius*	Year	Annual temperature anomalies *degrees Celsius*	Year	Annual temperature anomalies *degrees Celsius*	Year	Annual temperature anomalies *degrees Celsius*
1867	-0.26	1898	-0.29	1929	-0.29	1960	0.04
1868	-0.28	1899	-0.18	1930	-0.30	1961	0.13
1869	-0.25	1900	-0.08	1931	-0.02	1962	0.17
1870	-0.33	1901	-0.16	1932	-0.11	1963	0.16
1871	-0.41	1902	-0.27	1933	-0.22	1964	-0.15
1872	-0.24	1903	-0.42	1934	-0.10	1965	-0.11
1873	-0.27	1904	-0.43	1935	-0.17	1966	-0.10
1874	-0.42	1905	-0.41	1936	-0.11	1967	-0.03
1875	-0.46	1906	-0.25	1937	0.00	1968	-0.05
1876	-0.42	1907	-0.38	1938	0.07	1969	0.07
1877	-0.21	1908	-0.45	1939	0.01	1970	0.01
1878	-0.08	1909	-0.32	1940	-0.08	1971	-0.04
1879	-0.29	1910	-0.29	1941	-0.05	1972	0.04
1880	-0.27	1911	-0.36	1942	-0.02	1973	0.12
1881	-0.27	1912	-0.38	1943	0.05	1974	-0.04
1882	-0.31	1913	-0.35	1944	0.17	1975	-0.06
1883	-0.40	1914	-0.24	1945	0.06	1976	-0.13
1884	-0.46	1915	-0.15	1946	-0.05	1977	0.04
1885	-0.41	1916	-0.24	1947	-0.09	1978	-0.03
1886	-0.27	1917	-0.37	1948	-0.05	1979	0.13
1887	-0.34	1918	-0.25	1949	-0.07	1980	0.14
1888	-0.37	1919	-0.30	1950	-0.08	1981	0.20
1889	-0.22	1920	-0.28	1951	0.03	1982	0.10
1890	-0.32	1921	-0.17	1952	0.06	1983	0.15
1891	-0.33	1922	-0.29	1953	0.08	1984	0.12
1982	-0.36	1923	-0.25	1954	-0.15	1985	0.10
1893	-0.41	1924	-0.35	1955	-0.10	1986	0.17
1894	-0.33	1925	-0.14	1956	-0.14	1987	0.25
1895	-0.31	1926	-0.14	1957	0.10	1988	0.31
1896	-0.17	1927	-0.16	1958	0.10	1989	0.33
1897	-0.20	1928	-0.16	1959	0.05	1990	0.38

Source: The Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Trends '91: A Compendium of Data on Global Change, pp. 516-517, (Oak Ridge, TN: DOE, 1991).

Note: Global surface temperature anomalies are relative to a 1950-1979 reference period mean and are based on corrected land and marine data. Temperature anomaly estimates are adjusted for the influence of El Nino/Southern Oscillation, which could explain 20-30 percent of observed high frequency temperature variance.

Table 42.—Global carbon dioxide emissions, from anthropogenic sources, 1950-1989.

Year	Solid	Liquid	Gas	Cement	Gas flaring	Total	Per capita
			million metric tons of carbon				*metric tons of carbon*
1950	1,077	423	97	18	23	1,638	0.65
1951	1,137	479	115	20	24	1,775	0.69
1952	1,127	504	124	22	26	1,803	0.69
1953	1,132	533	131	24	27	1,848	0.70
1954	1,123	557	138	27	27	1,871	0.69
1955	1,215	625	150	30	31	2,050	0.74
1956	1,281	679	161	32	32	2,185	0.78
1957	1,317	714	178	34	35	2,278	0.80
1958	1,344	732	192	36	35	2,338	0.80
1959	1,390	790	214	40	36	2,471	0.83
1960	1,419	580	235	43	39	2,586	0.86
1961	1,356	905	254	45	42	2,602	0.85
1962	1,358	981	277	49	44	2,708	0.86
1963	1,404	1,053	300	51	47	2,855	0.89
1964	1,442	1,138	328	57	51	3,016	0.92
1965	1,468	1,221	351	59	55	3,154	0.95
1966	1,485	1,325	380	63	60	3,314	0.97
1967	1,455	1,424	410	65	66	3,420	0.98
1968	1,456	1,552	445	70	73	3,596	1.01
1969	1,494	1,674	487	74	80	3,809	1.05
1970	1,571	1,838	516	78	87	4,091	1.11
1971	1,571	1,946	554	84	88	4,242	1.12
1972	1,587	2,056	583	89	94	4,409	1.15
1973	1,594	2,240	608	95	110	4,648	1.18
1974	1,591	2,244	618	96	107	4,656	1.16
1975	1,686	2,131	623	95	93	4,629	1.13
1976	1,732	2,313	647	103	109	4,895	1.18
1977	1,786	2,390	646	108	104	5,034	1.19
1978	1,802	2,383	674	116	107	5,082	1.18
1979	1,899	2,535	714	119	100	5,366	1.23
1980	1,921	2,409	725	120	89	5,264	1.18
1981	1,930	2,272	735	121	72	5,129	1.13
1982	1,993	2,178	734	121	69	5,094	1.11
1983	1,998	2,163	736	125	63	5,085	1.09
1984	2,088	2,188	785	128	57	5,243	1.10
1985	2,196	2,169	819	131	55	5,369	1.11
1986	2,253	2,274	836	136	52	5,551	1.12
1987	2,310	2,285	876	142	48	5,661	1.13
1988	2,388	2,388	916	150	55	5,897	1.15
1989	2,392	2,419	946	152	56	5,967	1.15

Source: The Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Trends '91: A Compendium of Data on Global Change, p. 389, (Oak Ridge, TN: DOE, 1991).

Table 43.—Global atmospheric concentrations of carbon dioxide, 1958-1990.

Year	Mauna Loa, Hawaii	South Pole	American Samoa	Point Barrow, Alaska
		parts per million by volume		
1958	315.6	314.5	na	na
1959	315.8	315.5	na	na
1960	316.8	316.9	na	na
1961	317.5	317.7	na	na
1962	318.3	317.3	na	na
1963	318.8	318.1	na	na
1964	319.6	318.3	na	na
1965	319.9	319.3	na	na
1966	321.2	320.6	na	na
1967	322.0	321.3	na	na
1968	322.8	321.6	na	na
1969	323.9	322.4	na	na
1970	325.3	324.1	na	na
1971	326.2	324.8	na	na
1972	327.3	325.9	na	na
1973	329.5	327.4	na	327.9
1974	330.1	328.3	na	332.6
1975	331.0	330.4	na	333.2
1976	332.0	330.5	330.6	334.0
1977	333.7	331.9	332.5	334.7
1978	335.3	333.6	335.3	336.7
1979	338.7	334.8	336.3	337.9
1980	338.5	336.9	338.0	339.9
1981	339.8	338.1	338.3	340.9
1982	341.0	339.3	340.4	342.4
1983	342.5	341.0	341.8	343.7
1984	344.3	342.4	343.7	345.5
1985	345.7	343.6	344.4	346.7
1986	347.0	345.2	345.9	348.5
1987	348.8	346.9	347.9	349.8
1988	351.4	348.8	350.0	353.0
1989	352.8	350.3	351.5	355.0
1990	359.0	351.5	352.7	355.5

Source: The Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Trends '91: A Compendium of Data on Global Change, pp. 15, 19, 23, 27, (Oak Ridge, TN: DOE, 1991).

Table 44.—Global emissions of chlorofluorocarbons 11 and 12, 1931-1989.

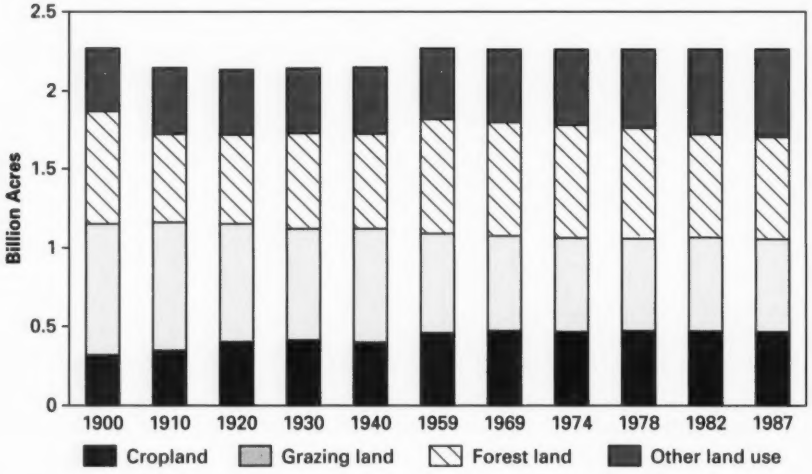
Year	CFC-11	CFC-12	Year	CFC-11	CFC-12
	million kilograms			*million kilograms*	
1931	0.0	0.1	1961	52.1	99.7
1932	0.0	0.1	1962	65.4	114.5
1933	0.0	0.1	1963	80.0	133.9
1934	0.0	0.2	1964	95.0	155.5
1935	0.0	0.3	1965	108.3	175.4
1936	0.0	0.5	1966	121.3	195.0
1937	0.0	0.8	1967	137.6	219.9
1938	0.1	1.2	1968	156.8	246.5
1939	0.1	1.7	1969	181.9	274.3
1940	0.1	2.3	1970	206.6	299.9
1941	0.1	3.0	1971	226.9	321.8
1942	0.1	3.7	1972	255.8	349.9
1943	0.2	4.5	1973	292.4	387.3
1944	0.2	6.1	1974	321.4	418.6
1945	0.3	8.0	1975	310.9	404.1
1946	0.6	13.9	1976	316.7	390.4
1947	1.3	21.3	1977	303.9	371.2
1948	2.3	24.8	1978	283.6	341.3
1949	3.8	26.6	1979	263.7	337.5
1950	5.5	29.5	1980	250.8	332.5
1951	7.6	32.4	1981	248.2	340.7
1952	11.0	33.7	1982	239.5	337.4
1953	15.0	37.9	1983	252.8	343.3
1954	18.6	42.9	1984	271.1	359.4
1955	23.0	48.2	1985	280.8	368.4
1956	28.7	56.1	1986	295.1	376.5
1957	32.2	63.8	1987	310.6	386.5
1958	30.2	66.9	1988	314.5	392.8
1959	30.9	74.8	1989	265.2	364.7
1960	40.5	89.1			

Source: Chemical Manufacturers Association, Production, Sales, and Calculated Release of CFC-11 and CFC-12 through 1989, tables 1 and 2, (Washington, DC: CMA, 1990).

Note: Data are supplied by reporting companies participating in the Chemical Manufacturers Association's chlorofluorocarbon research program.

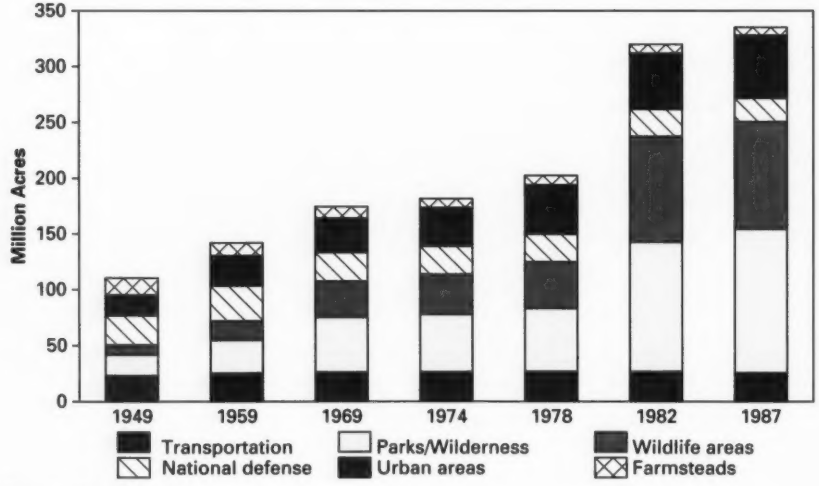
Land, Agriculture, and Forestry

Figure 16.—Land use in the United States, 1900-1987.



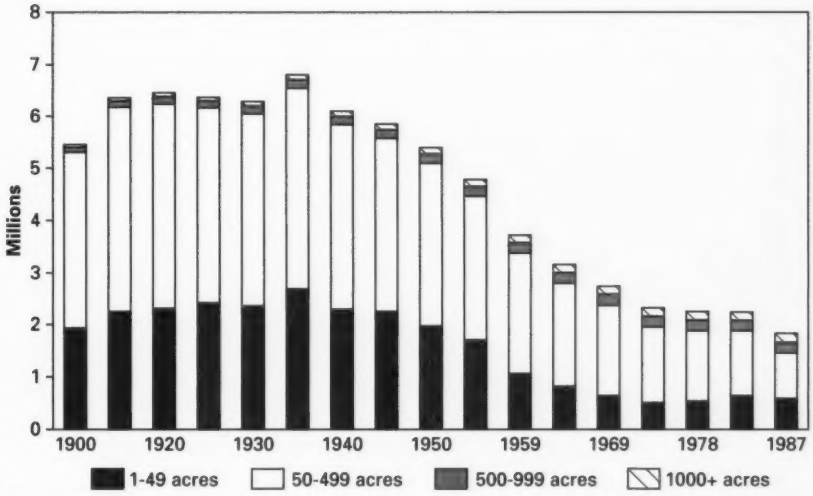
Source: See Table 45.

Figure 17.—Special uses of land, 1949-1987.



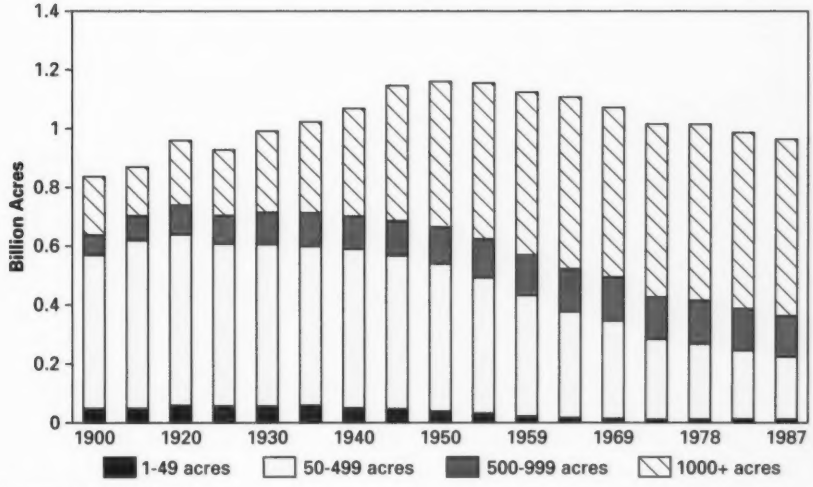
Source: See Table 46.

Figure 18a.—Number of farms in the United States, by farm size, 1900-1987.



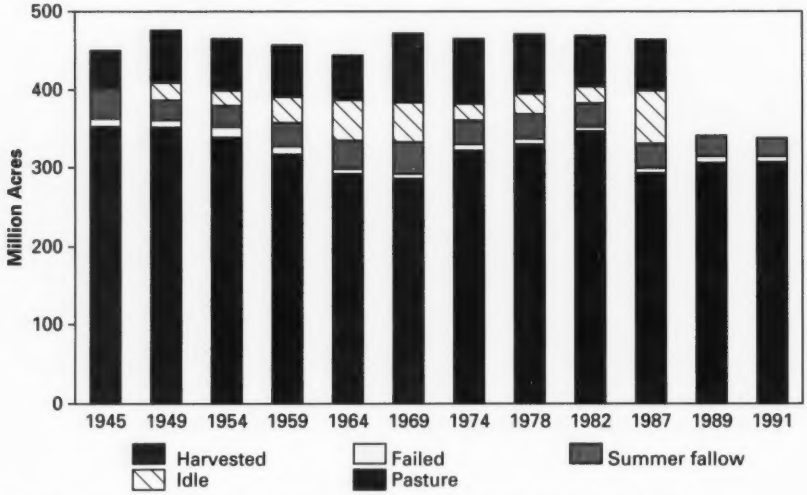
Source: See Table 47.

Figure 18b.—Land in farms in the United States, by farm size, 1900-1987.



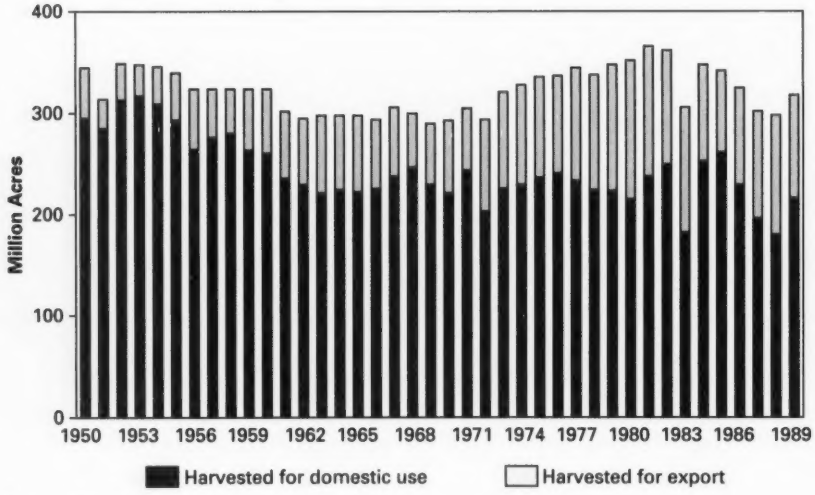
Source: See Table 47.

Figure 19.—Major uses of cropland, 1945-1991.



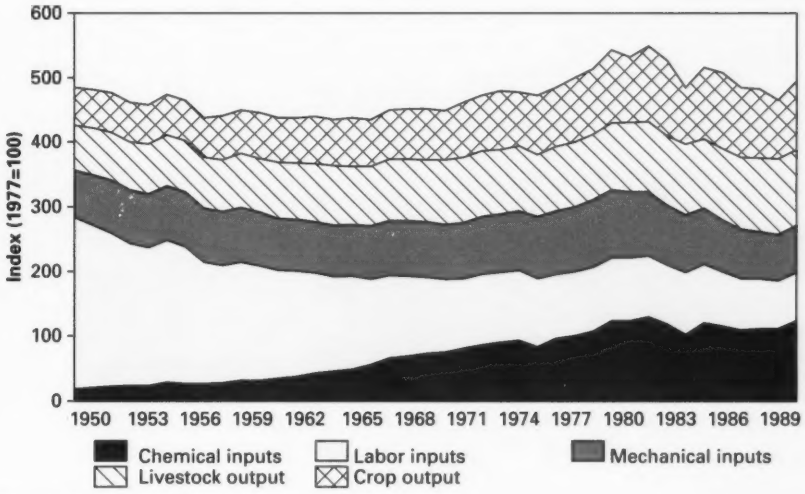
Note: Acres of idle cropland and cropland pasture not available 1989 and 1991.
Source: See Table 48.

Figure 20. —Cropland acreages harvested for export and domestic uses, 1950-1989.



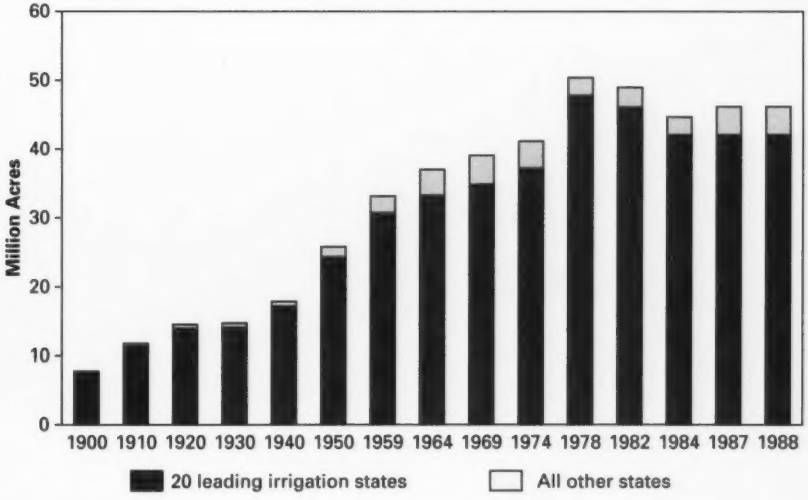
Source: See Table 49.

Figure 21.—Agricultural inputs and outputs, 1950-1989.



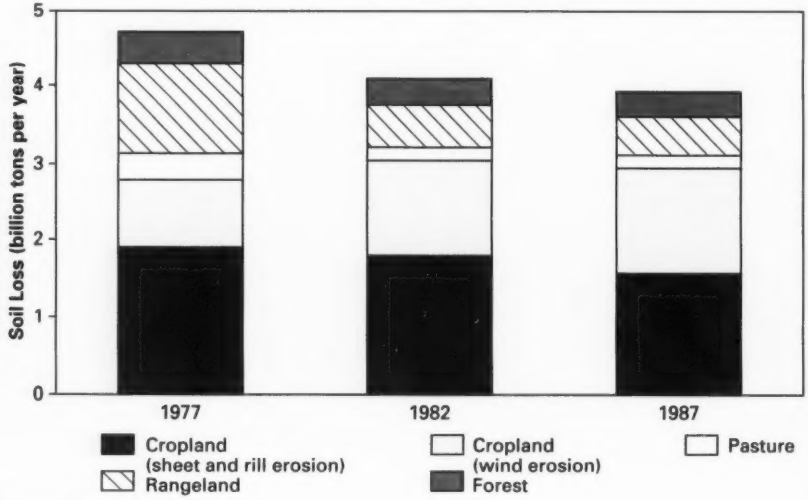
Source: See Table 51.

Figure 22.—Irrigated farmland, 1900-1988.



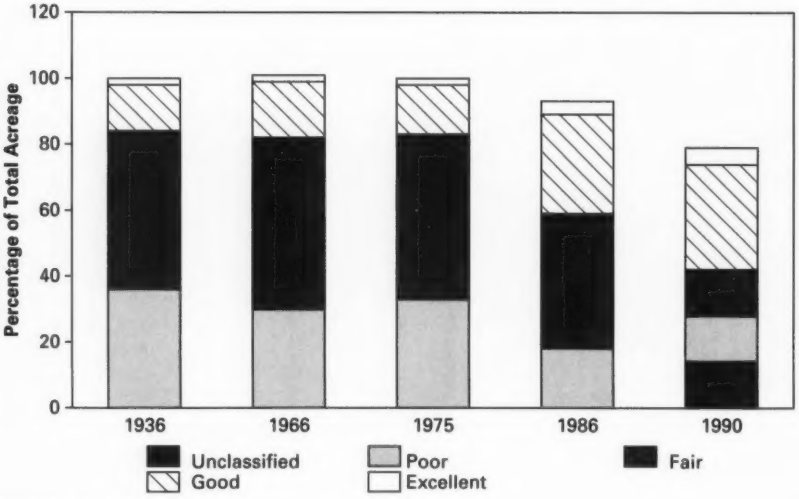
Source: See Table 55.

Figure 23.—Soil erosion on nonfederal agricultural lands, 1977-1987.



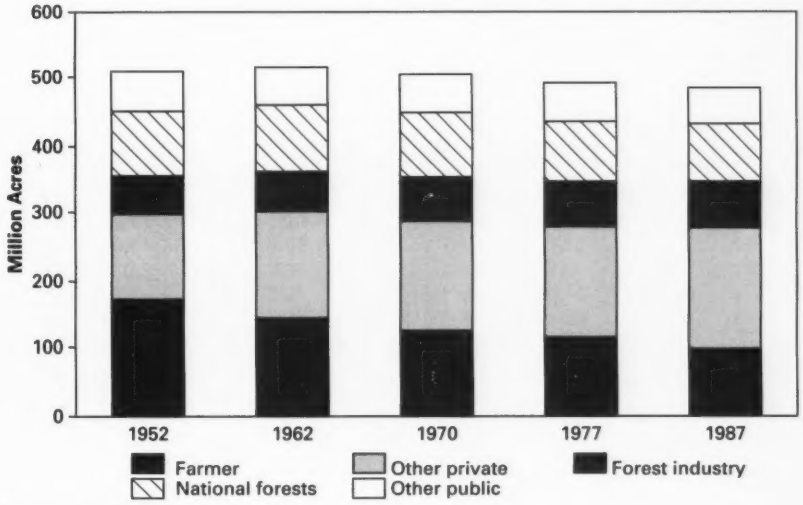
Source: See Table 50.

Figure 24.—Condition of Bureau of Land Management rangeland, 1936-1990.



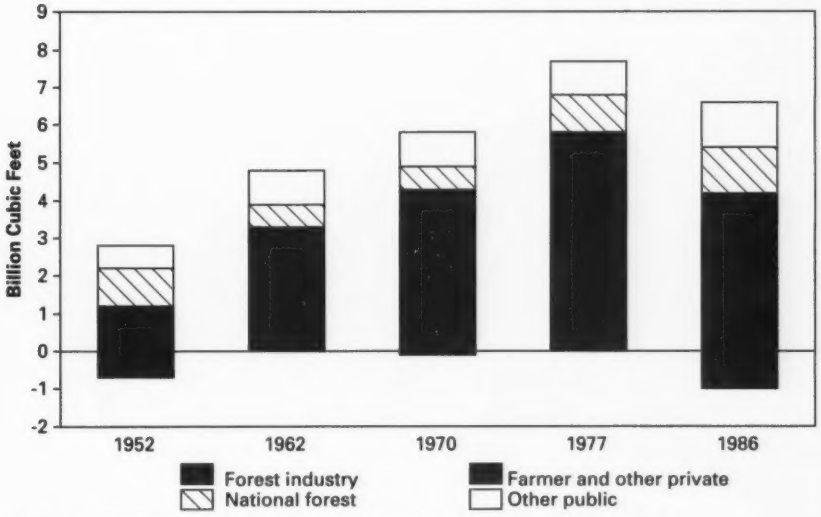
Source: See Table 56.

Figure 25.—Timberland in the United States, by ownership, 1952-1987.



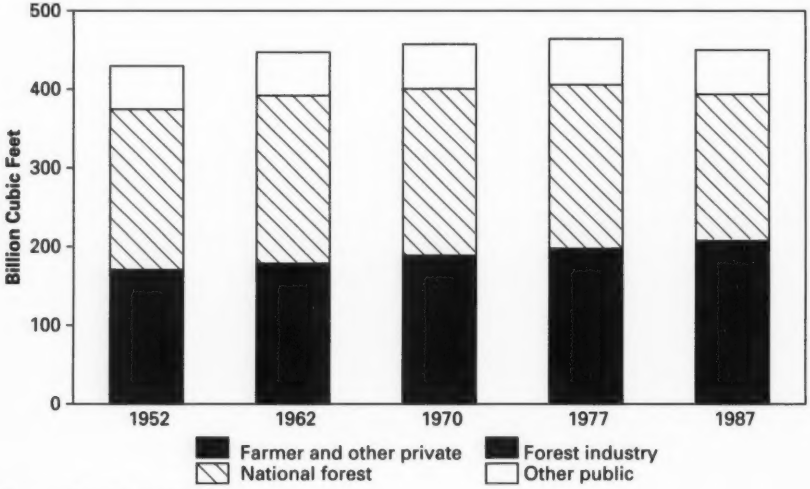
Source: See Table 57.

Figure 26.—Net growth of U.S. timber stocks, by ownership, 1952-1986.



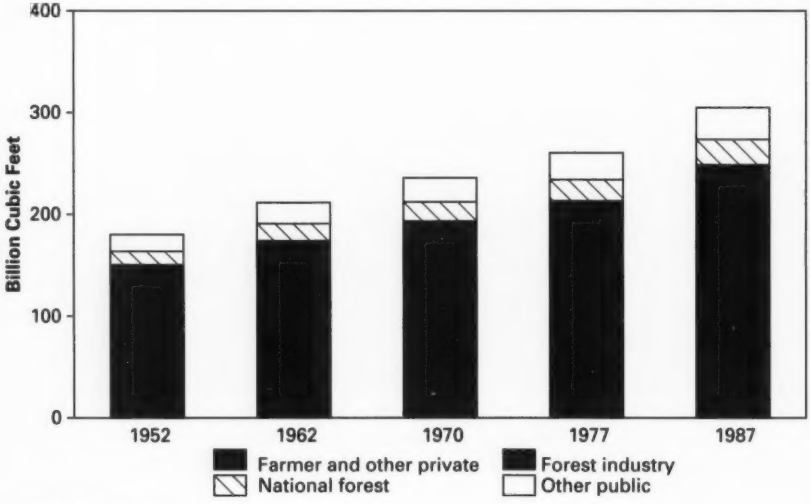
Note: Net growth=annual growth minus annual removal of growing stocks.
Source: See Table 59.

Figure 27.—Volume of softwood timber in the United States, by ownership, 1952-1987.



Source: See Table 58.

Figure 28.—Volume of hardwood timber in the United States, by ownership, 1952-1987.



Source: See Table 58.

Table 45.—Land use and ownership in the United States, 1900-1987.

	Land use						Ownership	
Year	Crop-land	Grazing land	Forest land	Special use	Other land	Total	Private land	Public domain
	million acres						%	
1900	319	832	719	na	400	1,904	52.7	47.3
1910	347	814	562	na	424	1,904	68.5	31.5
1920	402	750	567	86	330	1,904	73.8	26.2
1930	413	708	607	na	416	1,904	74.0	26.0
1940	399	723	602	99	327	1,904	73.7	26.3
1959	458	633	728	123	329	2,271	66.2	33.8
1969	472	604	723	141	324	2,264	66.5	33.5
1974	465	598	718	147	336	2,264	66.5	33.5
1978	471	587	703	158	345	2,264	67.2	32.9
1982	469	597	655	270	274	2,265	67.9	32.2
1987	464	591	648	279	283	2,265	68.1	31.9

Source: Daugherty, A.B., Major Uses of Land in the United States: 1987, AER 535 and earlier reports in this series, (Washington, DC: DOA, Economic Research Service, 1991). U.S. Department of Commerce, Bureau of the Census. Statistical Abstract of the United States, (Washington, DC: DOC, annual).

Notes: The total land area of the United States increased in 1959 with the addition of Alaska and Hawaii as states. Other changes in total land area result from refinements in measuring techniques. Public land includes original public-domain lands vested in the U.S. Government by virtue of its sovereignty as well as lands acquired by the U.S. Government by purchase, condemnation, and gift. Historical estimates are based on imperfect data. Special use land ncludes rural transportation areas, areas used primarily for recreation and wildlife purposes, various public installations and facilities, farmsteads and farm roads. Other includes urban areas, areas in miscellaneous uses not inventoried, and marshes, open swamps, bare rock areas, desert, tundra, and other land generally having low value for agricultural purposes. Land use and land ownership estimates are not strictly comparable.

Table 46.—Special uses of land in the United States, 1949-1987.

Land use	1949	1959	1969	1974	1978	1982	1987
				million acres			
Transportation	22.9	25.2	26.0	26.3	26.6	26.7	25.7
Parks and wilderness	18.8	29.7	49.3	51.6	56.6	115.8	128.5
Wildlife areas	8.9	17.2	32.1	35.8	41.4	95.2	96.4
National defense	26.3	31.1	25.6	25.0	24.9	24.0	20.9
Urban	18.3	27.2	31.0	34.8	44.6	50.2	56.6
Farmsteads & farm roads	15.1	11.4	10.3	8.1	8.4	8.0	7.1
Total	118.4	141.8	174.3	181.6	202.5	319.9	335.2

Source: Daugherty, A.B., Major Uses of Land in the United States: 1987, AER 535 and earlier reports in this series, (Washington, DC: DOA, ERS, 1991).

Note: Categories of special uses correspond to those listed as special in Table 45, except urban is listed as "other land" in Table 45.

Table 47.—Number of farms and land in farms, 1900-1987.

	Farm size category by acre								Total farms	
	1 - 49		50 - 499		500 - 999		1,000 +			
Year	Units	Area	Units	Area	Units	Area	Units	Area	Units	Area
	millions	*million acres*	*millions*	*million acres*	*millions*	*million acres*	*millions*	*million acres*	*millions*	*billion acres*
1900	1.93	49	3.37	520	0.10	68	0.05	200	5.74	0.84
1910	2.25	49	3.93	570	0.13	84	0.05	167	6.37	0.88
1920	2.31	59	3.93	580	0.15	100	0.07	221	6.45	0.96
1925	2.42	57	3.75	550	0.14	97	0.06	224	6.37	na
1930	2.36	56	3.69	550	0.16	109	0.08	277	6.30	0.99
1935	2.69	59	3.86	540	0.17	114	0.09	310	6.81	na
1940	2.29	50	3.55	540	0.16	112	0.10	366	6.10	1.07
1945	2.25	47	3.32	520	0.17	119	0.11	460	5.86	1.14
1950	1.97	39	3.12	500	0.18	126	0.12	495	5.39	1.16
1954	1.70	32	2.76	460	0.19	132	0.13	531	4.78	1.16
1959	1.06	22	2.32	410	0.20	137	0.14	555	3.71	1.12
1964	0.82	17	1.98	360	0.21	145	0.15	585	3.16	1.11
1969	0.64	14	1.73	320	0.22	148	0.15	578	2.73	1.06
1974	0.51	11	1.44	273	0.21	142	0.16	590	2.31	1.02
1978	0.54	12	1.34	256	0.21	147	0.16	600	2.26	1.02
1982	0.64	13	1.24	233	0.20	141	0.16	600	2.24	0.99
1987	0.59	12	0.87	212	0.20	139	0.17	602	2.09	0.96

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, (Washington, DC: DOC, 1976).

U.S. Department of Commerce, Bureau of the Census. Census of Agriculture for 1987, and earlier reports in this series, (Washington, DC: DOC, 1988).

Table 48.—Major uses of cropland, 1945-1991.

Year	Cropland used for crops						Diverted from production
	Harvested	Failed	Summer fallow	Idle	Cropland pasture	Total	
	million acres						*million acres*
1945	353	10	40	na	47	454	na
1949	352	9	26	22	67	478	na
1954	339	13	28	19	66	465	na
1959	317	10	31	33	66	457	22.5
1964	292	6	37	52	57	444	55.0
1969	286	6	41	51	88	472	57.5
1974	322	8	31	21	83	465	2.7
1978	330	7	32	26	76	471	18.3
1982	347	5	31	21	65	469	11.1
1987	293	6	32	68	65	464	76.2
1989	306	8	27	na	na	na	61.0
1991	307	7	24	na	na	na	63.0

Source: U.S. Department of Agriculture, Economic Research Service, Cropland, Water and Conservation Situation and Outlook Report, (Washington, DC: DOA, annual).

Notes: Acres of idle cropland, cropland pasture, and total cropland are estimated only for years coinciding with Census of Agriculture years. Data are for the conterminous United States. Cropland diversions occurred under federal farm programs.

Table 49.—Cropland acreages harvested for export and domestic uses, 1950-1989.

Year	Total cropland harvested	Cropland used to produce			Crop acreage in exports
		Exports	Domestic use goods	Domestic use per capita	
	million acres.			*acres*	%
1950	345	50	295	1.82	14.49
1951	344	29	285	1.73	8.43
1952	349	36	313	1.90	10.32
1953	348	31	317	1.90	8.91
1954	346	37	309	1.84	10.69
1955	340	47	293	1.72	13.82
1956	324	60	264	1.52	18.52
1957	324	48	276	1.57	14.81
1958	324	44	280	1.57	13.58
1959	324	61	263	1.45	18.83
1960	324	64	260	1.41	19.75
1961	302	67	235	1.26	22.19
1962	295	66	229	1.20	22.37
1963	298	77	221	1.15	25.84
1964	298	74	224	1.15	24.83
1965	298	76	222	1.14	25.50
1966	294	69	225	1.14	23.47
1967	306	69	237	1.19	22.55
1968	300	54	246	1.22	18.00
1969	290	61	229	1.13	21.03
1970	293	72	221	1.08	24.57
1971	305	62	243	1.17	20.33
1972	294	91	203	0.97	30.95
1973	321	96	225	1.06	29.91
1974	328	99	229	1.07	30.18
1975	336	100	236	1.09	29.76
1976	337	97	240	1.10	28.78
1977	345	112	233	1.06	32.46
1978	338	114	224	1.00	33.73
1979	348	125	223	0.99	35.92
1980	352	137	215	0.94	38.92
1981	366	129	237	1.03	35.25
1982	362	113	249	1.07	31.22
1983	306	124	182	0.77	40.52
1984	348	96	252	1.06	27.59
1985	342	81	261	1.09	23.68
1986	325	96	229	0.95	29.54
1987	302	106	196	0.81	35.10
1988	298	118	180	0.73	39.60
1989	318	102	216	0.87	32.08

Source: U.S. Department of Agriculture, Economic Research Service, Economic Indicators of the Farm Sector: Production and Efficiency Statistics, (Washington, DC: DOA, annual).

Table 50.—Soil erosion on nonfederal agricultural lands, 1977-1987.

Year	Sheet and rill erosion			Wind erosion		
	Cultivated cropland	Uncultivated cropland	Total	Cultivated cropland	Uncultivated cropland	Total
	tons per acre per year		*billion tons per year*	*tons per acre per year*		*billion tons per year*
1977	5.07	3.37	1.90	5.96	1.91	0.89
1982	4.70	0.80	1.80	3.40	0.40	1.25
1987	4.10	0.90	1.58	3.60	0.70	1.37

Year	Sheet and rill erosion					
	Pasture		Range		Forest	
	tons per acre per year	*billion tons per year*	*tons per acre per year*	*billion tons per year*	*tons per acre per year*	*billion tons per year*
1977	2.59	0.35	2.83	1.15	1.18	0.43
1982	1.26	0.17	1.32	0.53	0.87	0.34
1987	1.28	0.17	1.28	0.49	0.79	0.31

Source: U.S. Department of Agriculture, Soil Conservation Service, National Resources Inventory, (Washington, DC: DOA, SCS, 1977, 1982, and 1987).

Notes: Data for 1977 are not strictly comparable to data for 1982 and 1987 because of different reporting methods. During the period 1982 to 1987, cropland acres with excessive and rill erosion decreased from 104 million to about 94 million acres, whereas cropland acres with excessive wind erosion damage increased from 72 million to 76 million acres.

Table 51.—Agricultural productivity indexes, 1950-1989.

Year	Inputs				Outputs			Total productivity
	Labor	Mechanical	Chemical	Total	Crops	Livestock	Total	
	Index (1977=100)							
1950	265	72	19	106	59	70	61	58
1951	251	77	21	106	60	73	63	60
1952	237	81	23	105	62	74	66	62
1953	220	82	24	103	62	74	66	64
1954	214	82	24	102	61	77	66	65
1955	220	83	29	104	63	79	69	66
1956	212	84	27	103	63	79	69	67
1957	188	83	27	100	62	78	67	67
1958	182	83	28	98	69	79	73	74
1959	183	84	32	101	68	83	74	73
1960	177	83	32	99	72	82	76	72
1961	167	80	35	98	70	86	76	78
1962	163	80	38	98	71	86	77	76
1963	155	79	43	98	74	89	80	82
1964	146	80	46	96	72	91	79	81
1965	144	80	49	97	76	89	82	84
1966	132	83	56	99	73	91	79	83
1967	128	85	66	98	77	94	83	86
1968	124	86	69	97	79	94	85	87
1969	118	86	73	96	80	95	85	88
1970	113	85	75	96	77	99	84	87
1971	108	87	81	97	86	100	92	93
1972	110	89	86	97	87	101	91	94
1973	109	90	90	98	92	99	93	95
1974	109	92	93	98	84	100	88	90
1975	106	96	83	97	93	95	95	99
1976	100	98	96	98	92	99	97	98
1977	100	100	100	100	100	100	100	100
1978	100	104	107	102	102	101	104	101
1979	99	104	123	103	113	104	111	105
1980	99	101	123	103	101	108	104	101
1981	96	98	129	103	117	109	118	115
1982	93	92	118	99	117	107	116	117
1983	97	89	102	96	88	109	96	99
1984	92	86	120	96	111	107	112	117
1985	85	80	115	92	118	110	118	125
1986	80	77	109	89	109	110	111	134
1987	78	73	111	89	108	113	110	124
1988	75	72	111	87	92	116	102	117
1989	76	73	123	88	107	116	114	128

Source: U.S. Department of Agriculture, Economic Research Service, Economic Indicators of the Farm Sector: Production and Efficiency Statistics, (Washington, DC: DOA, annual).

Notes: Livestock outputs=meat animals, dairy products, poultry and eggs, wool, mohair, honey, & beeswax. Crop outputs=feed grains, hay and forage, vegetables, fruit, nuts, sugar crops, cotton, tobacco, oil crops, & miscellaneous. Productivity=output/input.

Table 52.—Farm fuel use, 1974-1990.

Year	Gasoline	Diesel	Liquefied petroleum gas
		billion gallons	
1974	3.7	2.6	1.4
1975	4.5	2.4	1.0
1976	3.9	2.8	1.2
1977	3.8	2.9	1.1
1978	3.6	3.2	1.3
1979	3.4	3.2	1.1
1980	3.0	3.2	1.1
1981	2.7	3.1	1.0
1982	2.4	2.9	1.1
1983	2.3	3.0	0.9
1984	2.1	3.0	0.9
1985	1.9	2.9	0.9
1986	1.7	2.9	0.7
1987	1.5	3.0	0.6
1988	1.6	2.8	0.6
1989	1.6	3.2	0.6
1990	1.5	2.7	0.6

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, (Washington, DC: DOA, periodic).

Table 53.—Farm fertilizer use, 1940-1991.

Year	Quantity	Year	Quantity	Year	Quantity
	million tons		*million tons*		*million tons*
1940	1.8	1958	6.5	1976	20.8
1941	1.9	1959	7.4	1977	22.1
1942	2.1	1960	7.5	1978	20.6
1943	2.4	1961	7.8	1979	22.6
1944	2.6	1962	8.4	1980	23.1
1945	2.7	1963	9.5	1981	23.7
1946	3.1	1964	10.5	1982	21.4
1947	3.3	1965	11.0	1983	18.1
1948	3.6	1966	12.4	1984	21.8
1949	3.9	1967	14.0	1985	21.7
1950	4.1	1968	15.0	1986	19.7
1951	4.7	1969	15.5	1987	19.1
1952	5.2	1970	16.1	1988	19.6
1953	5.6	1971	17.2	1989	19.6
1954	5.9	1972	17.2	1990	20.6
1955	6.1	1973	18.0	1991	20.1
1956	6.1	1974	19.3		
1957	6.4	1975	17.6		

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, (Washington, DC: DOA, periodic).

Note: Quantity refers to tonnages of primary nutrients, nitrogen, phosphorus, and potash applied to farm fields and excludes fertilizer use on lawns, golf courses, home gardens, and other nonfarm lands.

Table 54.—Farm pesticide use, 1964-1991.

Year	Herbicides	Insecticides	Fungicides	Total
		million pounds of active ingredients		
1964	76	143	72	291
1966	112	138	79	328
1971	207	127	130	464
1976	374	130	146	650
1982	451	71	30	552
1986	410	59	6	475
1987	365	57	7	429
1988	372	60	8	440
1989	394	61	8	463
1990	392	63	8	463
1991	403	66	9	478

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, (Washington, DC: DOA, periodic).

Notes: For the years 1964, 1966, 1972, and 1976, estimates of pesticide use are for total use on all crops in the United States. The 1982 estimates are for major field and forage crops only and represent 33 major producing states, excluding California. The 1986-1990 estimates are for major U.S. field crops. Data for 1991 are projections.

Table 55.—Irrigated farmland, 1900-1988.

Year	Leading irrigation states	Other states	Total
		million acres	
1900	7.5	0.3	7.8
1910	11.3	0.4	11.7
1920	13.9	0.6	14.5
1930	14.1	0.6	14.7
1940	17.2	0.7	18.0
1950	24.3	1.5	25.8
1959	30.7	2.4	33.2
1964	33.2	3.8	37.1
1969	34.8	4.3	39.1
1974	37.2	4.0	41.2
1978	47.8	2.6	50.4
1982	46.1	2.9	49.0
1984	42.1	2.6	44.7
1987	42.1	4.1	46.2
1988	42.1	4.1	46.2

Source: U.S. Department of Commerce, Bureau of the Census, Census of Agriculture and Other Special Ranch and Irrigation Surveys, (Washington, DC: DOC: periodic).

Notes: Leading irrigation states for 1900-1974 are the 17 Western states: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Leading states for 1978-1987 are the 17 Western States plus Arkansas, Florida, and Louisiana. All other states are conterminous states. Not included are 0.9 million irrigated acres in 1984 and 1.6 million irrigated acres in 1988 on horticultural speciality or abnormal farms.

Table 56.—Condition of nonfederal rangeland, 1963-1987, and Bureau of Land Management rangeland, 1936-1990.

Rangeland condition	Nonfederal				Bureau of Land Management				
	1963	1977	1982	1987	1936	1966	1975	1986	1990
	% rangeland acreage								
Excellent	5	12	4	3	2	2	2	4	5
Good	15	28	30	30	14	17	15	30	32
Fair	40	42	45	47	48	52	50	41	14
Poor	40	18	16	14	36	30	33	18	14
Unclassified	na	na	5	6	na	na	na	na	14

Source: U.S. Department of Agriculture, Soil Conservation Service, National Resources Inventory for 1977, 1982, and 1987 and earlier surveys, (Washington, DC: DOA).

U.S. Department of the Interior, Bureau of Land Management, Public Land Statistics, (Washington, DC: DOI, annual).

Notes: BLM=Bureau of Land Management. na=not available. Data are not strictly comparable because of different survey methods.

Table 57.—Timberland in the United States, by ownership, 1952-1987.

Year	Farmer	Other private	Forest industry	National forests	Other public	Total
			million acres			
1952	172.8	124.3	59.0	94.7	58.1	508.9
1962	143.6	157.6	61.4	96.8	55.6	515.1
1970	124.4	161.9	67.6	94.6	55.6	504.1
1977	114.5	163.5	68.9	88.7	55.5	491.1
1987	97.0	179.4	70.6	85.2	51.1	483.3

Source: U.S. Department of Agriculture, Forest Service, Forest Statistics of the United States, 1987, Resource Bulletin PNW-RB-168, (Washington, DC: DOA, 1989).

Table 58.—Volume of timber on U.S. timberland, by ownership and wood type, 1952-1987.

	Farmer & other private		Forest industry		National forests		Other public		National total	
Year	Soft	Hard	Soft	Hard	Soft	Hard	Soft	Hard	Soft	Hard
					billion cubic feet					
1952	93.5	130.67	7.11	9.920	4.41	3.35	5.1	16.44	30.1	180.2
1962	102.9	149.0	75.7	25.0	213.6	16.9	55.6	20.6	447.9	211.5
1970	113.8	164.5	75.1	28.8	211.8	18.8	57.3	23.8	458.1	235.9
1977	123.7	181.3	74.1	31.8	208.0	21.0	58.9	26.3	464.6	260.4
1987	135.3	213.9	72.3	34.9	186.4	24.7	56.8	31.5	450.9	305.1

Source: U.S. Department of Agriculture, Forest Service, Forest Statistics of the United States, 1987, Resource Bulletin PNW-RB-168, (Washington, DC: DOA, 1989).

Table 59.—Annual growth and removal of timber stocks, by ownership, 1952-1986.

	Farmer and other private		Forest industry		National forest		Other public forests	
Year	Growth	Removal	Growth	Removal	Growth	Removal	Growth	Removal
				billion cubic feet				
1952	8.1	6.9	2.6	3.3	2.1	1.1	1.2	0.6
1962	9.5	6.4	3.2	3.0	2.5	1.9	1.6	0.7
1970	11.3	7.0	3.7	3.8	2.9	2.3	1.9	1.0
1976	12.6	6.8	4.2	4.2	3.1	2.1	2.0	1.1
1986	12.4	8.2	4.4	5.4	3.4	2.2	2.4	1.2

Source: U.S. Department of Agriculture, Forest Service, Forest Statistics of the United States, 1987, Resource Bulletin PNW-RB-168, (Washington, DC: DOA, 1989).

Table 60.—Roundwood harvest, by product, 1950-1990.

Year	Lumber	Plywood & veneer	Pulp products	Fuel	Miscellaneous	Total
			billion cubic feet			
1950	5.9	0.3	1.5	2.3	0.8	10.8
1951	5.8	0.4	1.8	2.2	0.7	11.0
1952	5.8	0.4	1.8	2.0	0.7	10.8
1953	5.7	0.5	1.9	1.9	0.7	10.7
1954	5.6	0.5	2.0	1.8	0.7	10.6
1955	5.8	0.6	2.2	1.7	0.7	11.0
1956	5.9	0.6	2.5	1.7	0.6	11.3
1957	5.1	0.6	2.4	1.6	0.6	10.2
1958	5.2	0.6	2.2	1.5	0.6	10.0
1959	5.7	0.7	2.4	1.4	0.6	10.8
1960	5.1	0.7	2.6	1.3	0.6	10.2
1961	4.9	0.8	2.5	1.2	0.6	10.0
1962	5.1	0.8	2.6	1.1	0.6	10.2
1963	5.4	0.9	2.7	1.1	0.7	10.6
1964	5.6	1.0	2.9	1.0	0.7	11.2
1965	5.7	1.0	3.1	0.9	0.8	11.5
1966	5.6	1.0	3.2	0.8	0.8	11.5
1967	5.3	1.0	3.2	0.8	0.9	11.2
1968	5.5	1.1	3.4	0.7	1.0	11.8
1969	5.4	1.1	3.6	0.6	1.0	11.6
1970	5.2	1.0	3.8	0.5	1.0	11.6
1971	5.4	1.2	3.6	0.5	0.9	11.5
1972	5.5	1.3	3.5	0.5	1.1	11.9
1973	5.7	1.3	3.8	0.5	1.2	12.4
1974	5.1	1.1	4.2	0.5	1.1	12.1
1975	4.9	1.2	3.5	0.6	1.0	11.1
1976	5.6	1.4	3.8	0.6	1.2	12.5
1977	5.9	1.4	3.6	1.0	1.2	13.2
1978	6.2	1.5	3.7	1.5	1.2	14.1
1979	6.1	1.4	4.1	2.2	1.4	15.2
1980	5.3	1.2	4.4	3.1	1.2	15.2
1981	4.8	1.2	4.1	3.2	0.9	14.3
1982	4.6	1.1	4.0	3.4	1.1	14.3
1983	5.4	1.4	4.2	3.2	1.1	15.3
1984	5.8	1.4	4.4	3.6	1.2	16.3
1985	5.7	1.4	4.2	3.4	1.2	16.0
1986	6.5	1.5	4.5	3.1	1.2	17.0
1987	7.0	1.7	4.7	3.1	1.4	17.8
1988	6.9	1.6	4.7	3.4	1.5	18.2
1989	6.8	1.6	5.0	3.4	1.6	18.3
1990	6.5	1.6	5.1	3.3	1.5	18.0

Source: U.S. Department of Agriculture, Forest Service, U.S. Timber Production, Trade, Consumption, and Price Statistics, 1960-1988, table 4, p. 13, and unpublished data, (Washington, DC: DOA, 1991).

Notes: Miscellaneous=log and pulp chip exports and other products not specified. Data for 1988-1990 are preliminary. Totals may not agree with detail because of rounding.

Table 61.—Forest fire damage and reforestation, 1930-1990.

Year	Forest fire damage	Reforestation	Year	Forest fire damage	Reforestation
	million acres			*million acres*	
1930	52.3	0.14	1970	3.3	1.60
1940	25.9	0.52	1971	4.3	1.69
1950	15.5	0.50	1972	2.6	1.68
1951	10.8	0.45	1973	1.9	1.75
1952	14.2	0.52	1974	2.9	1.60
1953	10.0	0.71	1975	1.8	1.93
1954	8.8	0.81	1976	5.1	1.89
1955	8.1	0.78	1977	3.2	1.98
1956	6.6	0.89	1978	3.9	2.09
1957	3.4	1.14	1979	3.0	2.06
1958	3.3	1.53	1980	5.3	2.27
1959	4.2	2.12	1981	4.8	1.93
1960	4.5	2.14	1982	2.4	2.37
1961	3.0	1.76	1983	5.1	2.45
1962	4.1	1.37	1984	3.0	2.55
1963	7.1	1.33	1985	5.2	2.70
1964	4.2	1.31	1986	3.2	2.75
1965	2.7	1.29	1987	5.0	3.03
1966	4.6	1.28	1988	5.7	3.39
1967	4.7	1.37	1989	3.5	3.02
1968	4.2	1.44	1990	4.6	2.86
1969	6.7	1.43			

Source: U.S. Department of Agriculture, Forest Service, Wildfire Statistics, (Washington, DC: DOA, annual).

U.S. Department of Agriculture, Forest Service, U.S. Forest Planting Report, (Washington, DC: DOA, annual).

Note: Reforestation refers to acres planted in seedlings and direct seeded.

Table 62.—Forest land damaged by insects, 1968-1990.

Year	Eastern spruce budworm	Western spruce budworm	Gypsy moth	Mountain pine beetle	Southern pine beetle
			million acres		
1968	1.3	5.3	0.1	na	na
1969	1.2	4.6	0.3	na	na
1970	2.0	4.0	1.0	na	na
1971	1.6	4.8	1.9	na	na
1972	2.8	5.5	1.4	na	na
1973	4.2	4.4	1.8	na	na
1974	10.8	5.5	0.8	na	na
1975	9.2	5.3	0.5	na	na
1976	9.1	5.8	0.9	na	na
1977	10.3	6.5	1.6	na	na
1978	7.7	5.2	1.3	4.0	na
1979	6.6	5.0	0.6	4.4	15.0
1980	6.6	4.0	5.0	4.7	12.1
1981	4.5	5.5	12.9	4.7	0.9
1982	4.2	8.7	8.2	4.2	7.3
1983	6.5	11.0	2.4	3.6	11.4
1984	6.1	10.6	1.0	3.3	na
1985	5.2	12.8	1.7	3.3	15.5
1986	1.0	13.2	2.4	3.5	26.4
1987	0.8	8.0	1.3	2.4	13.8
1988	0.3	6.1	0.7	2.2	7.9
1989	0.1	3.1	3.0	1.6	5.3
1990	0.2	4.6	7.3	0.9	4.2

Source: U.S. Department of Agriculture, Forest Service, Forest Pest Management, Insect and Disease Conditions in the United States, 1979-1983, (Washington, DC: DOA, 1985).

U.S. Department of Agriculture, Forest Service, Forest Pest Management, Insect and Disease Conditions in the United States, (Washington, DC: DOA, annual from 1986).

Note: na=not available.

Table 63.—Wetlands losses, by type, 1970's-1980's.

Wetlands type	1970's	1980's	Change
	million acres		*%*
Estuarine wetlands	5.53	5.47	- 1.1
Palustrine marshes	24.31	24.53	0.9
Palustrine shrub wetlands	15.51	15.35	- 1.0
Palustrine forested wetlands	55.15	51.75	- 6.2
Palustrine nonvegetated wetlands	5.35	6.14	14.8
Lacustrine wetlands	57.64	57.84	0.4
Riverine wetlands	5.12	5.19	1.3
Total wetland acreage	168.61	166.27	- 1.0

Source: Dahl, T.E. & C.E. Johnson, Status and Trends of Wetlands in the Conterminous United States, 1970's to 1980's, table 2, p. 8, (Washington, DC: DOI, FWS, 1991).

Table 64.—Wetlands losses, by state, 1780's-1980's.

State	Total surface area of state	Wetlands area		Wetlands losses
		1780's	1980's	
		million acres		%
Alabama	33.03	7.57	3.78	50
Alaska	375.30	170.20	170.00	<1
Arizona	72.90	0.93	0.60	36
Arkansas	33.99	9.85	2.76	72
California	101.56	5.00	0.45	91
Colorado	66.72	2.00	1.00	50
Connecticut	3.21	0.67	0.18	74
Delaware	1.32	0.48	0.22	54
Florida	37.48	20.33	11.04	46
Georgia	37.68	6.84	5.30	23
Hawaii	4.12	0.06	0.05	12
Idaho	53.47	0.88	0.39	56
Illinois	36.10	8.21	1.25	85
Indiana	23.23	5.60	0.75	87
Iowa	36.03	4.00	0.42	89
Kansas	52.65	0.84	0.44	48
Kentucky	25.85	1.57	0.30	81
Louisiana	31.05	16.19	8.78	46
Maine	21.26	6.46	5.20	20
Maryland	6.77	1.65	0.44	73
Massachusetts	5.28	0.82	0.59	28
Michigan	37.26	11.20	5.58	50
Minnesota	53.80	15.07	8.70	42
Mississippi	30.54	9.87	4.07	59
Missouri	44.60	4.84	0.64	87
Montana	94.17	1.15	0.84	27
Nebraska	49.43	2.91	1.91	35
Nevada	70.75	0.49	0.24	52
New Hampshire	5.95	0.22	0.20	9
New Jersey	5.02	1.50	0.92	39
New Mexico	77.87	0.72	0.48	33
New York	31.73	2.56	1.03	60
North Carolina	33.66	11.09	5.69	49
North Dakota	45.23	4.93	2.49	49
Ohio	26.38	5.00	0.48	90
Oklahoma	44.75	2.84	0.95	67
Oregon	62.07	2.26	1.39	38
Pennsylvania	29.01	1.13	0.50	56
Rhode Island	0.78	0.10	0.07	37
South Carolina	19.88	6.41	4.66	27
South Dakota	49.31	2.74	1.78	35
Tennessee	27.04	1.94	0.79	59

continued

Table 64 (continued).—Wetlands losses, by state, 1780's-1980's.

State	Total surface area of state	Wetlands area		Wetlands losses
		1780's	1980's	
		million acres		%
Texas	171.10	16.00	7.61	52
Utah	54.35	0.80	0.56	30
Vermont	6.15	0.34	0.22	35
Virginia	26.12	1.85	1.07	42
Washington	43.64	1.35	0.94	31
West Virginia	15.48	0.13	0.10	24
Wisconsin	35.94	9.80	5.33	46
Wyoming	62.66	2.00	1.25	38

Source: Dahl, T.E, Wetlands Losses in the United States 1780's to 1980's, Report to Congress, (Washington, DC: DOI, FWS, 1991).

Table 65.—Coastal wetlands distribution, by region and habitat, 1980's.

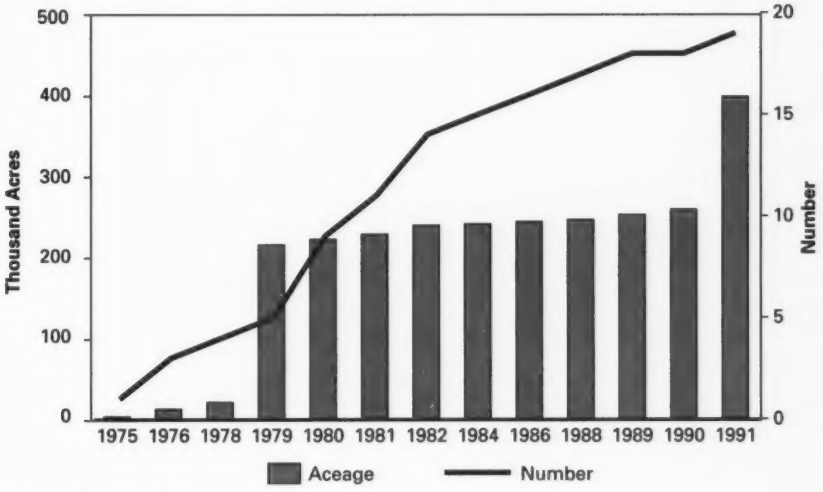
Region	Salt marsh	Fresh marsh	Forested & shrub	Tidal flats	Total
			thousand acres		
North Atlantic	68.00	58.30	927.60	142.80	1,196.80
Middle Atlantic	689.60	120.80	1,540.10	256.10	2,606.70
South Atlantic	894.20	1,311.60	5,943.20	101.60	8,250.50
Gulf of Mexico	2,496.60	2,751.10	8,211.80	507.50	13,967.00
Pacific	121.90	291.20	757.10	200.10	1,370.30
National total	4,270.30	4,532.80	17,380.20	1,208.00	27,391.20

Source: Field, D.W., A.J. Reyer, P.V. Genovese, and B.D. Shearer, Coastal Wetlands of the United States: An Accounting of a Valuable National Resource, (Washington, DC: DOC, NOAA, 1991).

Note: Data are not directly comparable to those presented in Table 63 because different quantitative methods were used for estimating wetland acreages by type. Coastal wetlands include all wetland areas (in addition to tidal wetlands) shown on FWS National Wetland Inventory maps within counties adjacent to marine waters (excluding Alaska and Hawaii).

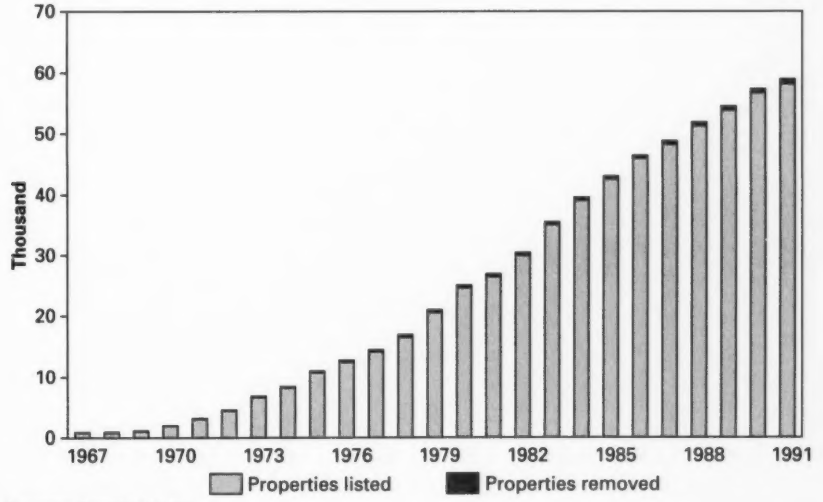
Protected Lands

Figure 29.—National Estuarine Research Reserves, 1975-1991.



Source: See Table 71.

Figure 30.—Properties listed on the National Register of Historic Places, 1967-1991.



Source: See Table 73.

Table 66.—National Park System, 1872-1991.

Year	Units	Land
	number	*million acres*
1872	1	2.2
1880	5	2.2
1890	12	3.8
1900	17	4.1
1910	45	7.9
1920	62	9.9
1930	98	10.8
1940	161	22.3
1950	182	24.6
1960	187	26.2
1970	282	29.6
1980	333	77.0
1991	358	80.3

Source: U.S. Department of the Interior, National Park Service, Areas Administered by the National Park Service: Information Tables, (Washington, DC: DOI, annual).

Table 67.—National Wildlife Refuge System, 1920-1991.

Year	Units	Land
	number	*million acres*
1920	36	na
1940	174	na
1946	242	17.5
1950	246	17.1
1955	276	17.3
1960	275	17.3
1965	299	28.4
1970	332	29.2
1975	378	32.3
1978	390	32.6
1980	419	69.9
1985	432	88.3
1991	503	88.5

Source: U.S. Department of the Interior, Fish and Wildlife Service, Lands Under the Control of the Fish and Wildlife Service, (Washington, DC: DOI, annual).

Note: na=not available.

Table 68.—National Forest System, 1891-1990.

Year	Forests	Land	Year	Forests	Land
	number	*million acres*		*number*	*million acres*
1891	1	1.24	1945	155	177.64
1895	17	17.93	1950	151	179.69
1900	38	46.52	1955	149	180.30
1905	83	75.35	1960	151	180.84
1910	149	168.03	1965	154	182.14
1915	162	162.77	1970	154	182.57
1920	152	156.03	1975	155	183.28
1925	159	158.40	1980	155	183.06
1930	149	160.09	1985	156	186.31
1935	142	163.31	1990	156	187.08
1940	160	174.77			

Source: U.S. Department of Agriculture, Forest Service, Land Areas of the National Forest System, (Washington, DC: DOA, annual).

Table 69.—National Wilderness Preservation System, 1964-1990.

Year	Land	Year	Land	Year	Land
	million acres		*million acres*		*million acres*
1964	9.24	1973	11.03	1982	79.88
1965	9.24	1974	11.38	1983	80.21
1966	9.24	1975	12.72	1984	88.55
1967	9.24	1976	14.45	1985	88.70
1968	10.03	1977	14.49	1986	88.80
1969	10.19	1978	19.00	1987	88.99
1970	10.40	1979	19.00	1988	90.81
1971	10.40	1980	79.71	1989	91.46
1972	11.03	1981	79.84	1990	94.97

Source: U.S. Department of Agriculture, Forest Service, National Wilderness Preservation System Fact Sheet, (Washington, DC: DOA, annual).

Table 70.—National Wild and Scenic River System, 1968-1991.

Year	Cumulative length	Year	Cumulative length	Year	Cumulative length
	miles		*miles*		*miles*
1968	773	1976	1,610	1984	7,217
1969	773	1977	1,610	1985	7,224
1970	868	1978	2,299	1986	7,363
1971	868	1979	2,299	1987	7,709
1972	895	1980	5,662	1988	9,264
1973	961	1981	6,908	1989	9,281
1974	1,018	1982	6,908	1990	9,318
1975	1,145	1983	6,908	1991	9,463

Source: U.S. Department of the Interior, National Park Service, River Mileage Classifications for Components of the National Wild and Scenic River System, (Washington, DC: unpublished data).

Table 71.—National Estuarine Research Reserves and National Marine Sanctuaries, 1975-1991.

Year	Estuarine Research Reserves		Marine Sanctuaries	
	Units	Area	Units	Area
	number	*acres*	*number*	*acres*
1975	1	4,700	2	64,640
1976	3	14,205	2	64,640
1978	4	22,605	2	64,640
1979	5	216,363	2	64,640
1980	9	223,426	3	865,920
1981	11	229,652	6	1,486,720
1982	14	240,571	6	1,486,720
1984	15	242,121	6	1,486,720
1986	16	245,149	7	1,487,360
1988	17	247,348	7	1,487,360
1989	18	253,477	8	1,741,440
1990	18	259,945	9	4,412,480
1991	19	399,302	9	4,412,480

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sanctuaries and Reserves Division, (Washington, DC: unpublished data).

Table 72.—National Register of Historic Places, 1967-1991.

Year	Properties listed	Properties removed	Year	Properties listed	Properties removed
1967	873	2	1980	24,680	403
1968	903	3	1981	26,499	406
1969	1,106	4	1982	29,999	420
1970	1,888	19	1983	35,112	434
1971	3,026	51	1984	39,121	440
1972	4,376	93	1985	42,538	445
1973	6,646	144	1986	45,936	452
1974	8,247	188	1987	48,254	525
1975	10,805	231	1988	51,286	574
1976	12,561	265	1989	53,838	635
1977	14,203	290	1990	56,688	651
1978	16,575	338	1991	58,209	756
1979	20,589	366			

Source: U.S. Department of the Interior, National Park Service, The National Register of Historic Places, (Washington, DC: unpublished data).

Table 73.—Distribution of protected areas within selected federal lands, 1990.

National Forest System	Land area	
	acres	*%*
National Wilderness Areas	33,609,661	17.97
National Primitive Areas	173,762	0.09
National Scenic Research Areas	6,416	0.00
National Wild and Scenic Rivers	331,212	0.18
National Recreation Areas	2,024,559	1.08
National Game Refuges	1,218,953	0.65
National Monuments	3,329,920	1.78
Research and Experimental Areas	64,933	0.03
Total protected area	40,694,483	21.75
Total NFS land	187,083,200	

Bureau of Land Management	Land area	
	acres	*%*
National Wilderness Areas	20,688,827	7.68
Areas of Critical Environmental Concern	6,623,313	2.46
Research Natural Areas	203,170	0.08
Outstanding Natural Areas	222,591	0.08
National Natural Landmarks	632,681	0.23
Total protected area	28,370,582	10.53
Total BLM land	269,553,883	

Source: U.S. Department of Agriculture, Forest Service, Land Areas of the National Forest System, (Washington, DC: DOA, annual).

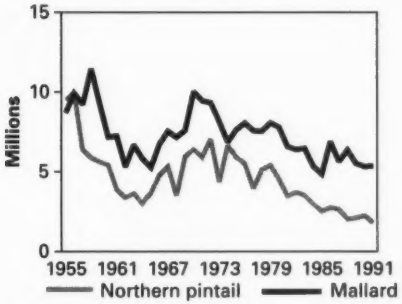
U.S. Department of the Interior, Bureau of Land Management, Public Land Statistics, (Washington, DC: DOI, annual).

U.S. Department of Agriculture, Forest Service, National Wilderness Preservation System Fact Sheet, (Washington, DC: DOA, annual).

Note: BLM=Bureau of Land Management. BLM also administers 1,982 miles of National Wild and Scenic Rivers.

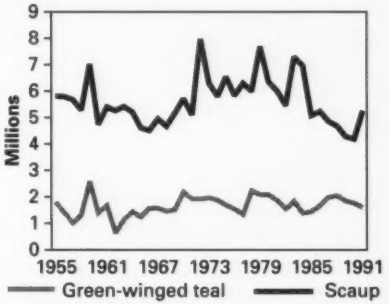
Wildlife and Fisheries

Figure 31a.—Breeding population estimates for northern pintail and mallard, 1955-1991.



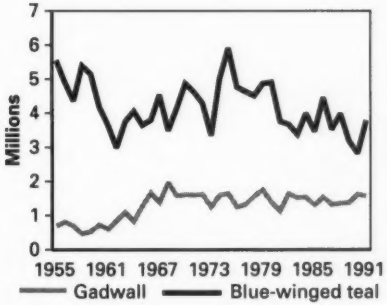
Source: See Table 76.

Figure 31b.—Breeding population estimates for green-winged teal and scaup, 1955-1991.



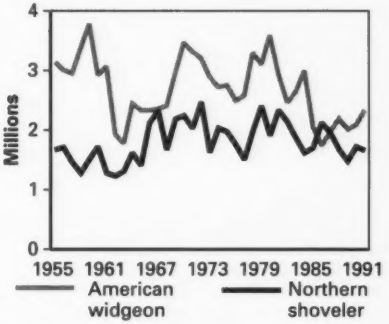
Source: See Table 76.

Figure 31c.—Breeding population estimates for gadwall and blue-winged teal, 1955-1991.



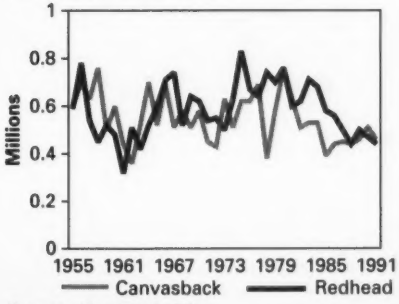
Source: See Table 76.

Figure 31d.—Breeding population estimates for American widgeon and northern shoveler, 1955-1991.



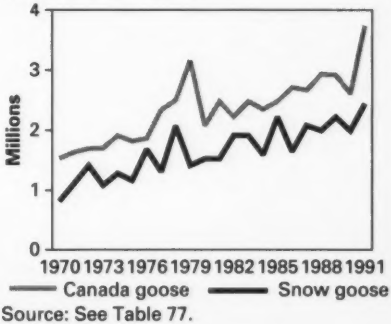
Source: See Table 76.

Figure 31e.—Breeding population estimates for canvasback and redhead, 1955-1991.



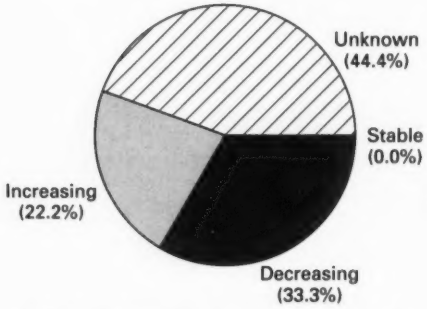
Source: See Table 76.

Figure 31f.—Population estimates for Canada goose and snow goose, 1970-1991.



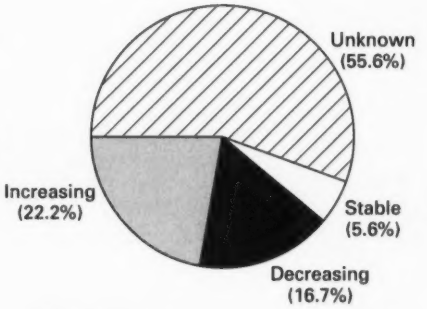
Source: See Table 77.

Figure 32a.—Status of Atlantic marine mammals, 1990.



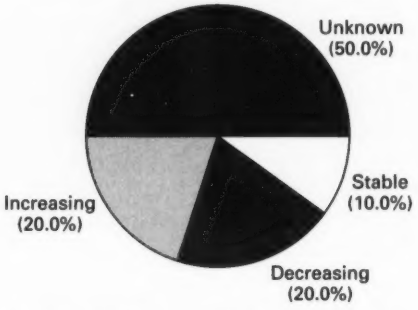
Note: Based on assessment of 9 species of Atlantic marine mammals.
Source: See Table 79.

Figure 32b.—Status of Pacific marine mammals, 1990.



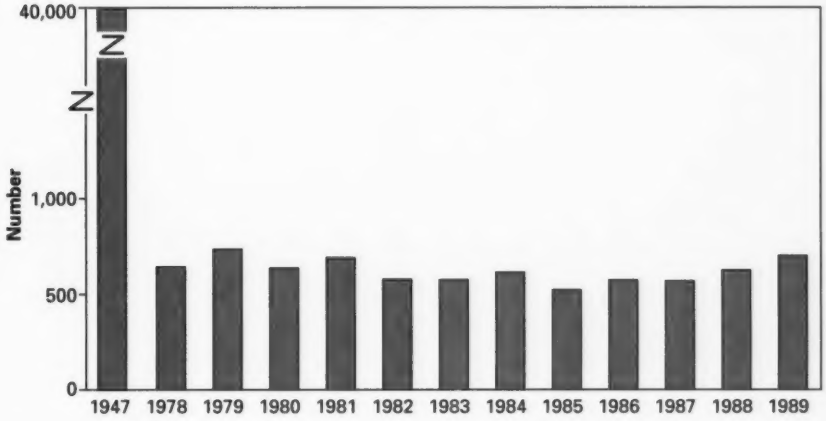
Note: Based on assessment of 18 species of Pacific marine mammals.
Source: See Table 79.

Figure 32c.—Status of female sea turtles that nest on U.S. beaches,1990.



Note: Based on assessment of 6 species of sea turtles.
Source: See Table 79.

Figure 33.—Nesting females of Kemp's ridley sea turtles, 1947-1990.



Source: See Table 79.

Table 74.—Trends in selected permanent resident bird populations, 1966-1990.

Common name	1966-1978	1980-1989	1989-1990
		% change per year	
Northern bobwhite	-3.6	-2.5	- 1.3
Great horned owl	0.8	0.3	-16.3
Downy woodpecker	-0.2	-0.6	- 3.1
Hairy woodpecker	1.8	0.3	-11.0
Pileated woodpecker	1.2	1.4	2.1
Black-capped chickadee	1.8	1.5	1.7
Carolina chickadee	0.0	-0.8	2.7
Tufted titmouse	-2.0	1.9	5.6
Brown-headed nuthatch	-1.9	-1.3	16.8
Carolina wren	1.2	3.5	11.1
Northern mockingbird	-1.7	1.0	2.2
Northern cardinal	-0.9	0.4	5.8
House sparrow	-1.4	-2.7	7.7

Source: Robbins, C.S., J.R. Sauer, R.S. Greenberg, and S. Droege, Population declines in North American birds that migrate to the neotropics, pp. 7658-7662, Proc. Natl. Acad.Sci. 86 (1989).

U.S. Fish and Wildlife Service, Breeding Bird Survey, (Laurel, MD, unpublished data).

Table 75.—Trends in selected neotropical migrant bird populations, 1966-1990.

Common name	1966-1978	1980-1989	1989-1990
		% change per year	
Yellow-billed cuckoo	1.8	-7.0	22.6
Whip-poor-will	0.6	-2.3	-1.1
Eastern wood pewee	-2.1	-1.4	1.9
Least flycatcher	-1.6	-0.1	8.6
Veery	1.6	-2.3	-1.8
Wood thrush	1.3	-3.9	13.6
White-eyed vireo	0.3	-2.1	6.7
Red-eyed vireo	2.8	1.0	1.3
Tennessee warbler	18.6	-4.2	0.2
Blackburnian warbler	1.3	-0.8	1.0
American redstart	1.3	-1.0	9.6
Prothonotary warbler	4.4	-1.0	30.7
Ovenbird	1.0	-1.2	6.3
Common yellowthroat	0.2	-0.6	3.8
Yellow-breasted chat	-4.5	-2.0	1.3
Scarlet tanager	2.6	0.6	1.7
Rose-breasted grosbeak	6.1	-1.2	-15.9
Indigo bunting	0.4	-1.2	-1.6

Source: Robbins, C.S., J.R. Sauer, R.S. Greenberg, and S. Droege, Population declines in North American birds that migrate to the neotropics, pp. 7658-7662, Proc. Natl. Acad. Sci. 86 (1989).

U.S. Fish and Wildlife Service, Breeding Bird Survey, (Laurel, MD, unpublished data).

Table 76.—Duck population estimates, 1955-1991.

Year	Northern pintail	Mallard	Canvasback	Redhead	Gadwall	Green-winged teal	Blue-winged teal	Scaup	American widgeon	Northern shoveler	Total
						millions					
1955	9.52	8.71	0.60	0.59	0.69	1.80	5.55	5.82	3.14	1.67	38.08
1956	9.97	9.93	0.70	0.78	0.81	1.41	4.90	5.80	3.01	1.71	39.02
1957	6.36	9.23	0.63	0.54	0.69	1.02	4.36	5.68	2.95	1.46	32.91
1958	5.86	11.45	0.76	0.45	0.46	1.32	5.39	5.29	3.37	1.28	35.62
1959	5.61	9.23	0.50	0.52	0.53	2.58	5.15	7.02	3.78	1.51	36.43
1960	5.40	7.17	0.60	0.48	0.72	1.38	4.18	4.74	2.92	1.72	29.31
1961	3.86	7.24	0.44	0.32	0.60	1.69	3.65	5.40	3.07	1.28	27.54
1962	3.40	5.31	0.36	0.51	0.85	0.64	2.99	5.26	1.93	1.23	22.46
1963	3.62	6.68	0.52	0.42	1.09	1.14	3.75	5.42	1.78	1.31	25.72
1964	3.03	5.82	0.70	0.52	0.83	1.44	4.05	5.21	2.44	1.62	25.64
1965	3.68	5.26	0.52	0.60	1.27	1.24	3.65	4.61	2.33	1.41	24.56
1966	4.78	6.72	0.69	0.71	1.67	1.56	3.80	4.51	2.33	2.12	28.88
1967	5.29	7.53	0.51	0.74	1.38	1.57	4.53	4.95	2.35	2.32	31.17
1968	3.51	7.15	0.58	0.52	1.97	1.45	3.49	4.67	2.41	1.67	27.41
1969	5.92	7.59	0.51	0.64	1.58	1.51	4.15	5.17	2.96	2.18	32.18
1970	6.40	10.03	0.58	0.62	1.61	2.18	4.87	5.71	3.47	2.24	37.70
1971	5.90	9.46	0.45	0.54	1.60	1.92	4.62	5.11	3.32	2.03	34.96
1972	7.05	9.33	0.43	0.55	1.62	1.92	4.29	7.97	3.20	2.47	38.82
1973	4.36	8.15	0.63	0.50	1.25	1.97	3.35	6.31	2.89	1.63	31.04
1974	6.64	6.85	0.51	0.63	1.60	1.88	5.01	5.81	2.72	2.03	33.67
1975	5.90	7.63	0.62	0.83	1.64	1.69	5.91	6.54	2.75	1.97	35.48
1976	5.48	8.05	0.62	0.67	1.25	1.54	4.76	5.84	2.49	1.76	32.47
1977	3.95	7.56	0.69	0.64	1.32	1.33	4.63	6.30	2.58	1.51	30.51
1978	5.11	7.54	0.38	0.74	1.57	2.23	4.51	6.00	3.30	1.98	33.35
1979	5.39	8.06	0.58	0.70	1.75	2.08	4.87	7.68	3.10	2.40	36.60
1980	4.52	7.79	0.76	0.76	1.40	2.08	4.91	6.35	3.59	1.91	34.06
1981	3.48	6.57	0.63	0.60	1.14	1.87	3.76	6.01	2.93	2.33	29.33
1982	3.71	6.38	0.51	0.62	1.64	1.54	3.67	5.47	2.46	2.14	28.17
1983	3.52	6.46	0.53	0.71	1.52	1.84	3.38	7.29	2.64	1.87	29.74
1984	2.98	5.33	0.53	0.68	1.54	1.38	3.99	6.97	3.00	1.62	28.01
1985	2.51	4.84	0.39	0.58	1.31	1.44	3.47	5.08	2.05	1.70	23.37
1986	2.74	6.87	0.44	0.56	1.54	1.66	4.45	5.23	1.74	2.12	27.35
1987	2.63	5.63	0.45	0.50	1.32	1.98	3.53	4.85	1.98	1.95	24.82
1988	2.01	6.35	0.44	0.44	1.36	2.05	3.98	4.68	2.19	1.68	25.18
1989	2.10	5.50	0.46	0.50	1.38	1.85	3.19	4.28	2.01	1.48	22.75
1990	2.24	5.31	0.51	0.47	1.62	1.77	2.83	4.19	2.09	1.72	22.74
1991	1.80	5.35	0.46	0.44	1.57	1.60	3.78	5.25	2.33	1.66	24.24

Source: U.S. Department of the Interior, Fish and Wildlife Service, Office of Migratory Bird Management in conjunction with the Canadian Wildlife Service, Status of Waterfowl and Fall Flight Forecast, (Washington, DC: DOI, annual).

Table 77.—Goose and swan population estimates, 1970-1991.

Year	Canada goose	Snow goose	Greater white-fronted goose	Brant	Tundra swan
	millions			*thousands*	
1970	1.531	0.818	136	142	55
1971	1.634	1.116	168	300	58
1972	1.693	1.413	84	198	63
1973	1.701	1.084	174	166	57
1974	1.912	1.285	201	219	64
1975	1.817	1.167	174	212	67
1976	1.863	1.679	180	249	79
1977	2.338	1.311	255	221	76
1978	2.497	2.072	336	209	70
1979	3.160	1.415	300	173	79
1980	2.076	1.525	377	215	60
1981	2.476	1.524	232	291	93
1982	2.223	1.916	416	227	73
1983	2.479	1.914	355	233	86
1984	2.349	1.593	190	260	81
1985	2.482	2.223	254	291	94
1986	2.711	1.646	373	239	91
1987	2.669	2.080	323	240	94
1988	2.931	1.995	303	270	77
1989	2.918	2.222	377	266	91
1990	2.606	1.994	475	281	91
1991	3.739	2.440	492	275	97

Source: U.S. Department of the Interior, Fish and Wildlife Service, Office of Migratory Bird Management in conjunction with the Canadian Wildlife Service, Status of Waterfowl and Fall Flight Forecast, (Washington, DC: DOI, annual).

Table 78.—Utilization of fishery stocks in U.S. waters, 1990.

Fishery	Utilization status of assessed fisheries				Total assessed
	Unknown	Over	Full	Under	
	number of species				
Northeast demersal	2	15	5	3	25
Northeast pelagic	-	-	2	4	6
Atlantic anadromous	3	1	1	-	5
Northeast invertebrate	-	2	3	-	5
Atlantic highly migratory pelagic	3	2	4	1	10
Atlantic shark	1	1	-	1	3
Atlantic coastal migratory pelagic	3	3	-	1	7
Atlantic/Gulf/Caribbean reef fish	17	10	1	-	28
Southeast drum and croaker	4	3	-	-	7
Southeast menhaden and butterfish	-	1	1	1	3
Southeast/Caribbean invertebrate	5	8	1	-	14
Pacific coast salmon	-	5	-	-	5
Alaska salmon	-	-	5	-	5
Pacific coast and Alaska pelagic	-	-	2	2	4
Pacific coast groundfish	7	2	7	2	18
Western Pacific invertebrate	-	-	1	1	2
Western Pacific bottomfish*	-	2	-	4	6
Pacific highly migratory pelagic	12	2	1	3	18
Alaska groundfish	1	0	15	7	23
Alaska shellfish	1	0	2	1	4
Nearshore resources	20	8	6	-	34
Total assessed species	79	65	57	31	232
% of total	34	28	25	13	100

Source: Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Our Living Oceans, NOAA Tech. Memo. NMFS -F/ SPO-1, Washington, DC: DOC, 1991).

Notes: Determinations of fisheries utilization are based on traditional principles of fishery science. Over utilized=more fishing effort is used than is necessary to achieve long-term average catch. Fully utilized=amount of fishing is about equal to effort needed to achieve long-term average catch. Under utilized=when more effort is required to achieve long-term average catch. Demersal=bottom-dwelling fishes such as flounders, skates, and dogfish. Pelagic=mid-water fishes such as blue fish, anchovies, sardines, and squids. Anadromous=fishes which ascend rivers to spawn, such as salmon, shad, and striped bass. Invertebrate fisheries=lobsters, clams, scallops, and shrimp. Highly migratory=high-seas (oceanic) fishes such as tunas, swordfish, and billfishes. Coastal migratory=fishes that range from the shore to the outer edge of the U.S. continental shelf, such as king and Spanish mackeral, dolphin fish, and cobia. Reef fish=fishes that prefer coral reefs, artificial structures, and other hard bottom areas, such as snappers, groupers, and amberjacks. Reef fishes also includes tilefishes that prefer sand bottom areas. *=also includes armorhead.

Table 79.—Stock assessments of selected marine mammals and sea turtles, 1990.

Area and marine mammal species	Current abundance	Status	Trend
	# of individuals		
N.W. Atlantic			
Fin whale (E)	4,740	Unknown	Unknown
Humpback whale (E)	5,500	Possibly 65% of 1850 abundance	Increasing ?
Right whale (E)	350	Probably <5% of 1600 abundance	Declining ?
Pilot whale	11,200	Unknown	Unknown
Whitesided dolphin	27,600	Unknown	Unknown
Bottlenose (offshore)	4,275*	Possibly declined 50% in 1987-88	Declining ?
Harbor porpoise	3,500	Unknown	Declining ?
Harbor seal	10,500+	Unknown	Increasing ?
Mid-Atlantic coastal			
Bottlenose dolphin	600?	Possibly declined 50% in 1987-88	Declining ?
Gulf of Mexico			
Bottlenose dolphin	40,000*	Offshore and coastal	Unknown
W. Arctic			
Bowhead whale (E)	7,500	41% of 1848 abundance	Increasing
Pribilof Islands			
Northern fur seal (D)	871,000	<40% of late 1950s abundance	See note
N. Pacific			
Gray whale (E)	21,113	Recovered, => 1846 abundance	Increasing
Steller sea lion (T)	42,000	22% of late 1950 abundance	Declining
E. Pacific			
Humpback whale (E)	1,719*	Probably <15% of 1850 abundance	Unknown
Washington/Oregon			
Harbor porpoise	35,000?	Unknown	Increasing ?
California-Washington			
California sea lion	87,000	Unknown (see note)	Increasing
Harbor seal	42,000	Unknown	Increasing ?
Eastern Tropical Pacific			
N. spotted dolphin	658,300	Unknown	Declining
S. spotted dolphin	87,700	Unknown	Unknown
E. spinner dolphin	391,200	Unknown	Stable
Whitebelly sp. dolphin	363,300	Unknown	Unknown
N. common dolphin	177,700	Unknown	Unknown
C. common dolphin	568,000	Unknown	Unknown
S. common dolphin	1,657,500	Unknown	Unknown
N. striped dolphin	111,600	Unknown	Unknown
S. striped dolphin	1,115,600	Unknown	Unknown

continued

Table 79 (continued).—Stock assessments of selected marine mammals and sea turtles, 1990.

Area and sea turtle species	Historic abundance	Current abundance	Current Trend
		# of nesting females	
Atlantic			
Loggerhead (T)	Unknown	19,500	Stable
Green (T,E**)	Unknown	700	Increasing
Kemp's ridley (E)	40,000	700	Declining
Leatherback (E)	Unknown	Unknown	Unknown
Hawksbill (E)	Unknown	Unknown	Declining
Pacific			
Loggerhead (T)	Unknown	Unknown	Unknown
Green (T)	10,000	2,200	Increasing
Olive ridley (T)	Unknown	Unknown	Unknown
Leatherback (E)	Unknown	Unknown	Unknown
Hawksbill (E)	Unknown	75	Unknown

Source: Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Our Living Oceans, NOAA Tech. Memo. NMFS -F/SPO-1, Washington, DC: DOC, 1991).

Note: *=abundance estimates range from 1,050-7,500 for offshore N. Atlantic bottlenose dolphin, 17,254-37,946 for Whitesided dolphin, and 1,398-2,040 for E. Pacific Humpback whale. E=Endangered. T=Threatened. D=Depleted. **=endangered in Florida, threatened elsewhere. No significant trend since 1983 for Northern fur seal on St. Paul; declining at 6%/year on St. George. California sea lion status unknown, but believed to be at or above the level of maximum net production. Atlantic Kemp's ridley is declining at an average rate of 3%/year since 1978. Pacific Green turtle historic level for Hawaii only; current level is 2,000 in Hawaii and 100-300 in American Samoa; current level in Guam is unknown. Pacific Hawksbill current abundance in Hawaii; current abundance in Guam and American Samoa is unknown.

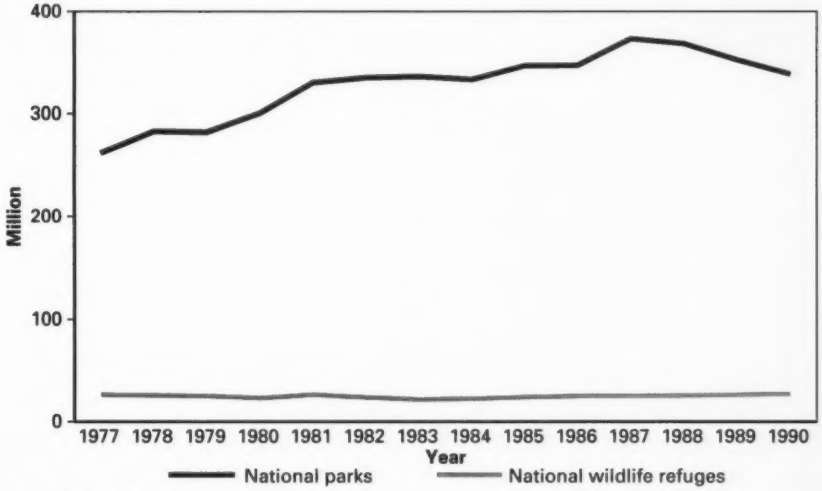
Table 80.—Threatened and endangered U.S. wildlife and plants, 1981-1991.

Group	Threatened						Endangered					
	1981	1983	1985	1987	1989	1991	1981	1983	1985	1987	1989	1991
	number (cumulative)											
Mammals	3	3	4	7	6	8	5	33	20	50	32	55
Birds	3	3	3	10	7	12	52	66	59	76	61	73
Reptiles	8	12	8	18	14	18	7	14	8	15	9	16
Amphibians	3	3	3	4	4	5	5	5	5	5	6	6
Fishes	12	12	14	30	25	34	29	33	30	47	49	54
Snails	5	5	5	5	6	6	2	3	3	3	3	7
Crustaceans	0	1	1	1	1	2	1	2	3	7	8	8
Insects	4	6	4	7	7	9	7	7	8	10	10	13
Arachnids	0	0	0	0	0	0	0	0	0	3	3	3
Clams	0	0	0	0	0	2	23	23	22	30	34	40
Plants	7	10	10	44	42	61	48	55	67	158	163	229
Total	45	55	52	126	112	157	189	243	225	404	378	511

Source: U.S. Department of the Interior, Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation, (Washington, DC: unpublished data).

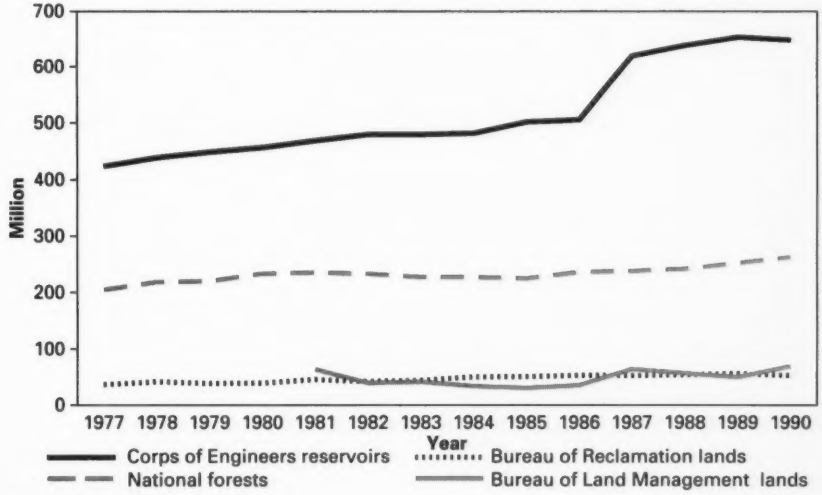
Recreation

Figure 34a.—Visitors to selected federal lands, 1977-1990.



Source: See Table 81.

Figure 34b.—Visitor days at selected federal lands, 1977-1990.



Source: See Table 81.

Table 81.—Visits to areas administered by federal agencies, 1977-1990.

Year	National parks	Wildlife refuges	National forests	COE reservoirs	BOR	BLM
	million visitors			*million visitor days*		
1977	262.6	26.5	204.8	424	36.9	na
1978	283.1	25.7	218.5	439	41.7	na
1979	282.4	25.2	220.2	449	38.7	na
1980	300.3	23.1	233.6	457	39.3	na
1981	329.7	26.4	235.7	469	45.8	63.8
1982	334.5	23.8	233.4	480	42.1	39.6
1983	335.6	21.7	227.7	480	44.3	41.8
1984	332.7	22.5	227.6	482	50.4	33.9
1985	346.2	24.0	225.4	502	50.9	30.6
1986	346.6	25.1	236.5	506	53.2	35.5
1987	372.9	25.3	238.5	620	53.1	64.3
1988	368.0	25.6	242.3	639	54.5	57.0
1989	351.9	26.4	252.5	654	56.3	49.7
1990	338.0	27.3	263.1	649	53.3	69.8

Source: U.S. Army Corps of Engineers, Directorate of Civil Works, Operations, Construction and Readiness Division, Natural Resources Management Branch, Visitation to Corps Recreation Areas, (Washington, DC: unpublished data).

U.S Department of Agriculture, Forest Service, Recreation Information Management System database, (Washington, DC: unpublished data).

U.S. Department of the Interior, Bureau of Land Management, Public Land Statistics, (Washington, DC: DOI, annual).

U.S. Department of the Interior, Bureau of Reclamation, Utilization of Recreation Areas on Reclamation Projects, (Denver, CO: data from the Commissioner's Annual Reports).

U.S. Department of the Interior, Fish and Wildlife Service, Refuge Division, Public use statistics database through 1987, with estimates for 1988-1990, (Washington, DC: unpublished data).

U.S. Department of the Interior, National Park Service, Statistical Office, National Park Statistical Abstract, (Denver, CO: DOI, annual).

Note: BLM=Bureau of Land Management. BOR=Bureau of Reclamation. COE=Corps of Engineers. Visitor days for BLM and National Forests are reported as 8-hour visitor days; for BOR as 12-hour visitor days; and for COE as recreation days of use (1977-1986) and visitor days (after 1986).

Table 82.—Fishing and hunting efforts in the United States, 1955-1985.

Year	Fishermen			Hunters				Total sports-men
	Fresh-water	Salt-water	Total	Small game	Big game	Water-fowl	Total	
	millions							
1955	18.42	4.56	20.813	9.82	4.41	1.99	11.78	24.92
1960	21.68	6.29	25.323	12.11	6.28	1.96	14.64	30.44
1965	23.96	8.31	28.348	10.58	6.57	1.65	13.58	32.88
1970	29.36	9.46	33.158	11.67	7.77	2.89	14.34	36.28
1975	36.60	13.74	41.299	14.18	11.04	4.28	17.09	45.77
1980	35.78	11.97	41.873	12.50	11.05	3.18	16.76	46.97
1985	39.12	12.89	45.345	11.13	12.58	3.20	16.34	49.83

Year	Fishing days			Hunting Days				Total sporting days
	Fresh-water	Salt-water	Total	Small game	Big game	Water-fowl	Total	
	millions							
1955	338.83	58.62	397.45	118.63	30.83	19.96	169.42	566.87
1960	386.17	80.60	465.77	138.19	39.19	15.16	192.54	658.31
1965	426.92	95.84	522.76	128.45	43.85	13.53	185.82	708.58
1970	592.49	113.69	706.19	124.04	54.54	25.11	203.69	909.88
1975	890.58	167.50	1,050.08	269.65	100.60	31.22	401.48	1,459.55
1980	788.39	164.04	952.42	225.79	117.41	26.18	348.54	1,300.98
1985	895.03	171.06	1,064.99	214.54	135.45	25.93	350.39	1,415.38

Source: U.S. Department of the Interior, Fish and Wildlife Service, National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, (Washington, DC: DOI, quinquennial).

Notes: Number of fishermen and hunters includes persons 12 years and older. The next survey will be completed in 1992.

Table 83.—Marine recreational fisheries catch, 1979-1990.

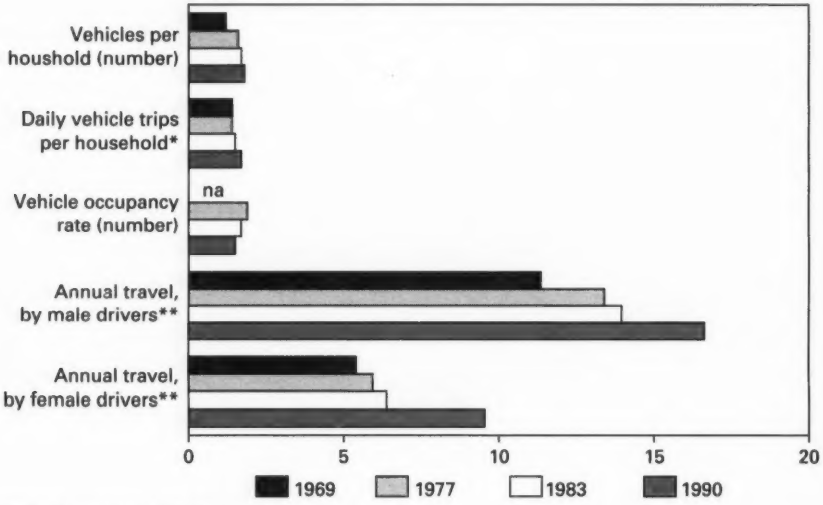
Year	Atlantic and Gulf Coasts		Pacific Coast	
	Number of fish caught	Number of angler trips	Number of fish caught	Number of angler trips
	millions		*millions*	
1979	439	63	49	8
1980	463	74	84	15
1981	331	52	51	11
1982	371	61	53	11
1983	398	69	45	11
1984	356	62	47	10
1985	382	71	43	10
1986	411	62	55	11
1987	288	55	46	10
1988	324	66	51	12
1989	240	48	41	9
1990	231	40	na	na

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Fisheries of the United States, 1990, Current Fisheries Statistics No. 9000, (Washington, DC: DOC, 1991).

Notes: na=not available. 1990 data are provisional.

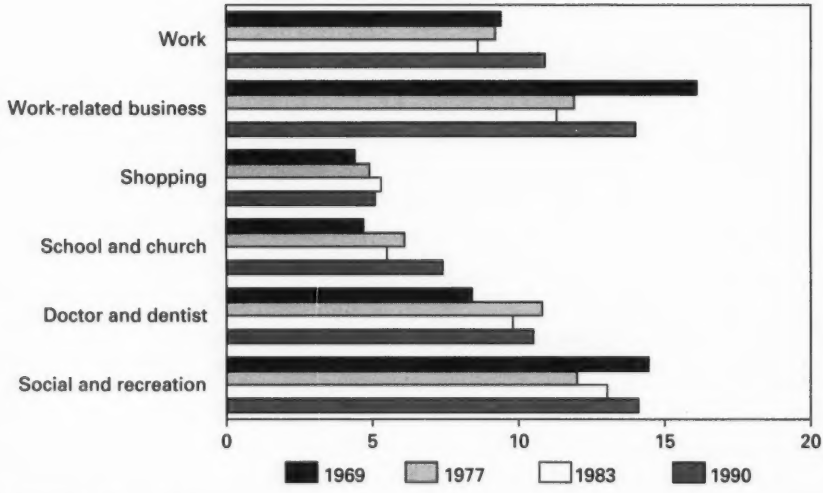
Transportation

Figure 35.—Characteristics of personal travel, 1969, 1977, 1983, and 1990.



Note: *=number. **=thousand miles.
Source: See Table 85.

Figure 36.—Average personal vehicle trip length, 1969, 1977, 1983, and 1990.



Source: See Table 85.

Table 84.—Personal travel and fuel consumption, 1969-1990.

Year	Total vehicle travel	Total automobile fuel consumption	Automobile fuel efficiency
	billion miles	*billion gallons*	*miles traveled per gallon*
1969	971.09	64.80	13.62
1970	916.70	67.82	13.52
1971	966.34	71.35	13.54
1972	1,021.37	76.22	13.40
1973	1,045.00	78.67	13.38
1974	1,007.25	75.08	13.40
1975	1,033.95	76.45	13.50
1976	1,078.22	79.69	13.50
1977	1,109.24	80.40	13.88
1978	1,146.51	81.66	14.00
1979	1,113.64	77.30	14.40
1980	1,111.60	71.88	15.50
1981	1,130.83	70.95	15.90
1982	1,166.26	70.06	16.70
1983	1,198.02	69.91	17.10
1984	1,224.92	68.72	17.80
1985	1,260.57	69.27	18.20
1986	1,310.56	71.40	18.27
1987	1,364.83	70.76	19.20
1988	1,439.55	71.95	19.87
1989	1,495.95	72.33	20.31
1990	1,515.31	72.43	20.92

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, table VM-1, (Washington, DC: DOT, annual).

Note: Personal passenger vehicles include automobiles and motorcycles in use.

Table 85.—Personal travel, per household, driver, and mode, 1969, 1977, 1983, and 1990.

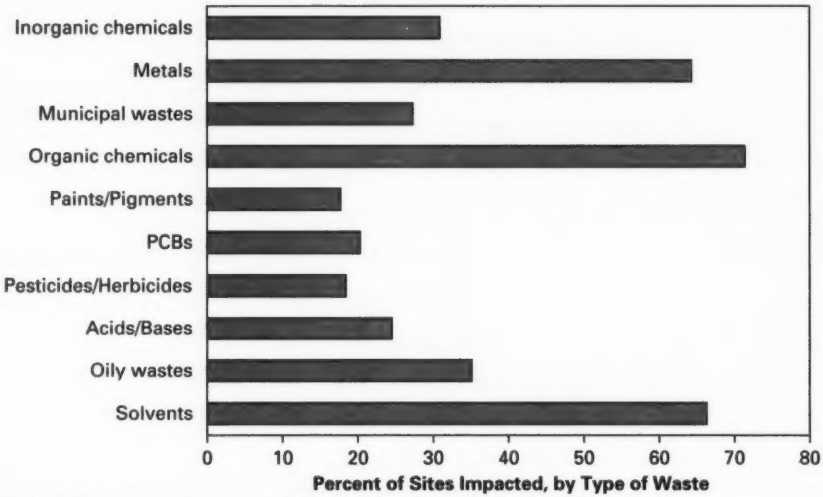
Characteristics of personal travel	Year			
	1969	1977	1983	1990
Vehicles per household (number)	1.20	1.60	1.70	1.80
Daily vehicle trips per household (number)	1.40	1.40	1.50	1.70
Daily vehicle miles per household (miles)	34.00	33.00	32.10	41.40
Average vehicle occupancy rate (number)	na	1.90	1.70	1.50
Average vehicle trip length (miles)	8.90	8.30	7.90	9.00
Work related	12.75	10.55	9.95	12.45
Family and personal business	6.00	7.13	6.78	7.55
Vacation	160.00	95.40	113.00	80.00
Social/recreation	14.45	12.00	13.03	14.10
Annual travel per driver (thousand miles)	8.69	10.01	10.59	13.18
Male driver	11.35	13.40	13.96	16.63
Female driver	5.41	5.94	6.38	9.54
Personal travel per mode (thousand miles)	7.12	8.82	8.48	9.53
Private vehicle	na	7.59	7.00	8.39
Public vehicle	na	0.24	0.51	0.22
Other	na	0.99	0.98	0.91

Source: U.S. Department of Transportation, Federal Highway Administration, 1990 Nationwide Personal Transportation Study: Early Results, (Washington, DC: DOT 1991).

Notes: Household vehicles include automobiles, station wagons, and vanbuses/mini-buses that are owned, leased, rented, or company owned and left at home to be regularly used by household members. They include vehicles used solely for business purposes or business-owned vehicles if left at home and used for the home-to-work trip; such as taxicabs and police cars. Average vehicle trip length for 1969 is for automobiles only. Family and personal business includes vehicle trips to school, church, doctor, shop, etc. Social/recreation includes vehicle trips to visit relatives and friends and other types of pleasure driving. Private vehicle modes of travel include automobile, van, pick-up truck, other truck, camper coach, and motorcycle. Public transportation includes bus, commuter rail, subway, elevated rail, streetcar, and trolley. Other includes airplane, Amtrak, taxi, school bus, moped, bicycle, and walking.

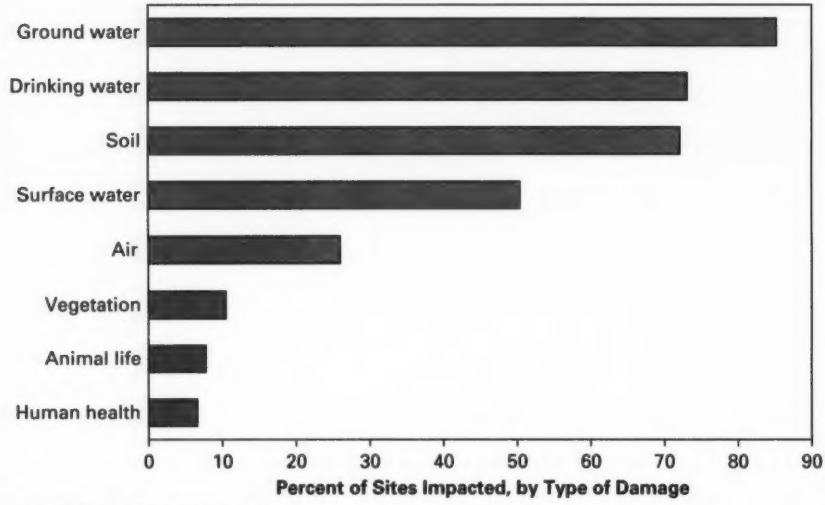
Environmental Waste and Hazards

Figure 37.—Predominant waste types at NPL sites, 1991.



Note: NPL=National Priority List. PCBs=Polychlorinated biphenyls.
Source: See Table 90.

Figure 38.—Environmental damage at NPL sites, 1991.



Note: NPL=National Priority List.
Source: See Table 90.

Table 86.—Municipal solid waste, 1960-1988.

Year	Gross discards		Materials recovery		Recovery	Net discards	
	Total	Per capita	Total	Per capita		Total	Per capita
	million tons	*pounds per day*	*million tons*	*pounds per day*	*%*	*million tons*	*pounds per day*
1960	87.8	2.66	5.9	0.18	6.7	81.9	2.48
1965	103.4	2.92	6.8	0.19	6.6	96.6	2.73
1970	121.9	3.27	8.6	0.23	7.1	113.3	3.04
1975	128.1	3.26	9.9	0.25	7.7	118.2	3.01
1980	149.6	3.61	14.5	0.35	9.7	135.1	3.26
1985	161.6	3.70	16.4	0.38	10.1	145.2	3.32
1988	179.6	4.00	23.5	0.52	13.1	156.0	3.48

Source: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Characterization of Municipal Solid Waste in the United States, 1990 Update, (Washington, DC: EPA, 1991).

Notes: Totals may not agree with detail because of independent rounding.

Table 87.—Municipal solid waste generation and recovery, by waste type, 1960-1988.

Year	Paper		Glass		Metal		Aluminum		Plastics	
	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery
	million tons									
1960	29.9	5.4	6.7	0.1	10.1	0.1	0.4	0.0	0.4	0.0
1965	38.0	5.7	8.7	0.1	10.6	0.4	0.5	0.0	1.4	0.0
1970	44.2	7.4	12.7	0.2	13.3	0.4	0.8	0.0	3.1	0.0
1975	43.0	8.2	13.5	0.4	13.2	0.6	1.1	0.1	4.5	0.0
1980	54.7	11.9	15.0	0.8	12.7	0.9	1.8	0.3	7.8	0.0
1985	61.5	13.1	13.2	1.0	11.9	0.6	2.3	0.6	11.6	0.1
1988	71.8	18.4	12.5	1.5	12.7	1.4	2.5	0.8	14.4	0.2

Year	Rubber & Leather		Textiles		Wood		Food		Yard	
	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery
	million tons									
1960	2.0	0.3	1.7	0.0	3.0	0.0	12.2	0.0	20.0	0.0
1965	2.6	0.3	1.9	0.0	3.5	0.0	12.7	0.0	21.6	0.0
1970	3.2	0.3	2.0	0.0	4.0	0.0	12.8	0.0	23.2	0.0
1975	3.9	0.2	2.2	0.0	4.4	0.0	13.4	0.0	25.2	0.0
1980	4.3	0.1	2.6	0.0	4.9	0.0	13.2	0.0	27.5	0.0
1985	3.8	0.2	2.8	0.0	5.4	0.0	13.2	0.0	30.0	0.0
1988	4.6	0.1	3.9	0.0	6.5	0.0	13.2	0.0	31.6	0.5

Source: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Characterization of Municipal Solid Waste in the United States, 1990 Update, (Washington, DC: EPA, 1991).

Table 88.—Accumulated volume and radioactivity of nuclear waste, 1963-1990.

	Low-level wastes at commercial disposal sites				
Year	Volume	Radio-activity	Year	Volume	Radio-activity
	million m3	*million curies*		*million m3*	*million curies*
1963	0.008	0.042	1977	0.514	3.765
1964	0.020	0.204	1978	0.593	4.383
1965	0.034	0.273	1979	0.676	4.539
1966	0.049	0.355	1980	0.768	4.547
1967	0.071	0.428	1981	0.852	4.483
1968	0.091	0.529	1982	0.929	4.568
1969	0.112	0.687	1983	1.007	4.732
1970	0.138	0.855	1984	1.083	4.954
1971	0.169	2.000	1985	1.160	5.282
1972	0.208	2.287	1986	1.213	5.059
1973	0.255	2.732	1987	1.265	4.924
1974	0.309	2.754	1988	1.306	4.793
1975	0.367	3.040	1989	1.352	5.284
1976	0.442	3.268	1990	1.384	5.349

	High-level wastes				
	DOE/defense sites			Commercial sites	
Year	Volume	Radio-activity	Year	Volume	Radio-activity
	million m3	*billion curies*		*thousand m3*	*million curies*
1980	0.30	1.31	1980	2.20	34.20
1981	0.31	1.58	1981	2.20	33.40
1982	0.34	1.32	1982	2.20	32.70
1983	0.35	1.25	1983	2.20	31.90
1984	0.36	1.40	1984	2.20	31.20
1985	0.36	1.47	1985	2.20	30.40
1986	0.36	1.42	1986	2.20	29.70
1987	0.38	1.28	1987	2.20	29.20
1988	0.38	1.18	1988	2.10	28.70
1989	0.38	1.08	1989	2.40	27.90
1990	0.40	1.02	1990	1.20	27.30

Source: U.S. Department of Energy, Integrated Data Base for 1991: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, (Washington, DC: DOE, 1991).

Notes: DOE=U.S. Department of Energy. defense=defense-related activities. m3= cubic meters.

Table 89.—CERCLIS and NPL sites, 1980-1991.

Hazardous site			Land use within 1 mile of NPL sites*	
Year	CERCLIS	NPL	Type	Percent of total
	number			%
1980	8,000	na	Residential	81.8
1981	10,500	na	Industrial	47.2
1982	13,934	na	Commercial	41.7
1983	16,307	545	Agricultural	34.5
1984	18,836	541	Forests/fields	26.8
1985	22,455	857	Military	8.7
1986	25,161	887	Department of Energy	1.6
1987	27,507	950	Mining	8.5
1988	29,613	1,174	Other/unspecified	24.1
1989	31,522	1,224		
1990	34,000	1,200		
1991	35,798	1,185		

Source: U.S. Environmental Protection Agency, Superfund NPL Characterization Project: National Results, (Washington, DC: EPA, 1991).

Notes: CERCLIS=Comprehensive Environmental Response, Compensation, and Liability Inventory Sites. NPL=National Priorities List. *=circa 1991.

Table 90.—Characteristics of NPL sites, 1991.

Hazardous wastes				Environmental damage	
Sources of wastes	Percent of NPL sites	Waste types at NPL sites	Percent of NPL sites	Impacts reported	Percent of NPL sites
	%		%		%
Manufacturing	38.9	Inorganic chemicals	30.9	Ground water	85.2
Municipal landfill	16.5	Metals	64.3	Drinking water	73.1
Industrial landfill	6.5	Municipal wastes	27.3	Soil	72.1
Recyclers	8.5	Organic chemicals	71.4	Surface water	50.4
DOE & DOD	5.0	Paints/Pigments	17.7	Air	26.0
Mining	2.0	PCBs	20.3	Vegetation	10.5
Other	22.5	Pesticides/Herbicides	18.4	Animal life	7.8
		Acids/Bases	24.5	Human health	6.6
		Oily wastes	35.1		
		Solvents	66.3		

Source: U.S. Environmental Protection Agency, Superfund NPL Characterization Project: National Results, (Washington, DC: EPA, 1991).

Notes: NPL=National Priorities List. DOE=Department of Energy. DOD=Department of Defense. PCBs=Polychlorinated biphenyls. na=not available.

Table 91.—U.S. production of synthetic organic chemical products, 1967-1989.

Product	Year											
	1967	1969	1971	1973	1975	1977	1979	1981	1983	1985	1987	1989
Crude coal tar	na	na	na	na	na	593	590	464	284	na	189	156
Petroleum	na	71	81	91	78	126	121	110	110	105	101	136
Cyclic intermed.	21	29	30	3	31	19	50	45	43	46	55	66
Dyes	206	240	244	284	206	264	266	230	244	222	255	467
Organic pigm'ts	53	61	58	69	50	69	88	76	78	81	94	134
Medic'l chem.	180	200	223	234	208	241	313	245	233	225	261	349
Flavor/perfume	112	120	96	117	101	150	195	165	174	152	126	172
Plastic & resin	14	19	21	30	25	35	42	41	44	50	60	72
Rubber	264	303	323	401	279	402	395	280	293	260	382	472
Elastomers	4	5	5	6	5	6	6	5	4	4	5	6
Plasticizers	1	1	2	2	1	2	2	2	2	2	2	3
Surface ag'ts	4	4	4	4	4	5	5	5	5	5	6	8
Pesticides	1	1	1	1	2	1	1	1	1	1	1	2
Miscellaneous	60	76	80	99	86	106	121	117	114	116	123	167

Source: U.S. International Trade Commission. Synthetic Organic Chemicals, United States Production and Sales, (Washington, DC: ITC, annual).

Notes: Quantities are million gallons for crude coal tar, million pounds for dyes, organic pigments, medicinal chemicals, flavor and perfume, and rubber, and billion pounds for petroleum, cyclic intermediates, plastic and resins, elasticizers, plasticizers, surface-active agents, pesticides, and miscellaneous. Petroleum=Primary products from petroleum and natural gas for chemical conversion.

Table 92.—Environmental distribution of TRI releases and transfers, by industry, 1989.

Industry	Total releases and transfers	Environmental distribution					
		Air	Surface water	Land	Under-ground	Public sewage	Off-site
	million lbs	*% of total releases and transfers*					
Food	67.80	27.77	4.15	6.41	1.63	55.26	4.79
Tobacco	1.49	93.14	3.04	0.10	0.00	1.11	2.61
Textiles	46.08	65.90	2.16	0.10	0.00	23.79	8.04
Apparel	2.06	65.78	0.01	0.02	0.00	21.42	12.76
Lumber	37.82	89.42	1.74	0.30	0.00	0.19	8.36
Furniture	65.37	92.51	0.00	0.03	0.00	0.93	6.52
Paper	313.25	61.94	13.46	3.17	0.00	14.68	6.75
Printing	60.92	90.85	0.01	0.00	0.00	1.23	7.91
Chemicals	2,745.77	27.07	3.98	3.89	39.75	12.65	12.66
Petroleum	103.14	51.20	3.65	2.31	24.35	11.82	6.66
Plastics	194.50	85.04	0.36	0.12	0.01	2.74	11.72
Leather	24.86	49.83	0.92	1.03	0.00	37.15	11.06
Stone/Clay	47.49	47.52	1.47	5.39	13.84	2.09	29.69
Primary metals	756.81	31.25	2.09	31.61	4.87	2.02	28.15
Fabr. metals	207.38	61.83	0.15	0.52	0.16	4.06	33.28
Machinery	74.92	72.30	0.53	0.41	0.00	3.79	22.96
Electrical	145.76	65.29	0.46	0.95	0.03	9.78	23.48
Transportation	245.32	80.50	0.05	0.07	0.00	3.18	16.20
Measure./Photo.	69.54	67.64	0.62	0.14	0.00	4.36	27.24
Miscellaneous	38.89	64.74	0.09	0.14	0.00	1.20	33.83
Multiple codes	437.28	54.80	2.18	17.30	4.40	5.91	15.41
No codes	19.22	60.27	0.87	0.23	0.00	9.32	29.32
Total	5,705.67	42.54	3.31	7.79	20.70	9.66	16.00

Source: U.S. Environmental Protection Agency, Office of Toxic Substances, Toxics in the Community: National and Local Perspectives, The 1989 Toxics Release Inventory National Report, EPA 560/4-91-014, (Washington, DC: EPA, 1991).

Table 93.—Oil spills in and around U.S. waters, 1970-1990.

Year	Number	Volume	Year	Number	Volume
	thousand spills	*million gallons*		*thousand spills*	*million gallons*
1970	3.71	15.25	1981	9.59	8.92
1971	8.74	8.84	1982	9.42	10.41
1972	9.93	18.81	1983	10.53	8.38
1973	11.05	15.29	1984	10.09	19.01
1974	12.08	15.74	1985	7.75	8.47
1975	11.00	21.53	1986	6.54	4.61
1976	11.07	18.52	1987	6.35	3.88
1977	10.98	8.19	1988	6.79	6.65
1978	12.17	11.04	1989	8.23	13.62
1979	11.56	10.05	1990	7.11	4.26
1980	9.89	12.64			

Source: U.S. Department of Transportation, United States Coast Guard, Polluting Incidents In and Around U.S. Waters, COMDTINST M16450.2H, (Washington, DC: DOT, 1989 with update by agency).

Research, Education and the Environment

Table 94.—Science and engineering degrees, by level and field, 1978-1988.

Degrees by field	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	Bachelor's										
	thousands										
Total	288.2	288.6	292.0	294.9	302.1	307.2	314.7	321.7	324.0	na	na
Sciences	240.7	234.9	232.7	230.8	234.3	234.3	238.1	243.9	246.9	na	na
Physical	17.2	17.3	17.5	17.5	17.3	16.2	15.8	16.3	15.8	na	na
Mathematics	12.7	11.9	11.5	11.2	11.7	12.6	13.3	15.3	16.4	na	na
Computer	7.2	8.8	11.2	15.2	20.4	24.7	32.4	39.1	42.2	na	na
Environmental	6.0	6.1	6.2	6.7	7.1	7.3	7.9	7.6	6.1	na	na
Life	77.1	75.1	71.6	68.1	65.0	63.2	59.6	57.8	56.5	na	na
Psychology	45.1	43.0	42.5	41.4	41.5	40.8	40.4	40.2	40.9	na	na
Social	75.5	72.8	72.3	70.8	71.2	69.5	68.6	67.6	69.0	na	na
Engineering	47.4	53.7	59.2	64.1	67.8	73.0	76.5	77.9	77.1	na	na
	Master's										
	thousands										
Total	56.2	54.5	54.4	54.8	57.0	58.9	59.6	61.3	62.5	na	na
Sciences	39.2	38.3	37.5	37.4	38.4	39.1	39.2	40.1	41.2	na	na
Physical	3.7	3.7	3.4	3.4	3.5	3.3	3.6	3.6	3.7	na	na
Mathematics	3.4	3.0	2.9	2.6	2.7	2.8	2.7	2.9	3.2	na	na
Computer	3.0	3.1	3.6	4.2	4.9	5.3	6.2	7.1	8.1	na	na
Environmental	1.8	1.8	1.8	1.9	2.0	2.0	2.0	2.2	2.2	na	na
Life	10.7	10.7	10.3	9.7	9.8	9.7	9.3	8.8	8.6	na	na
Psychology	8.2	8.0	7.9	8.0	7.8	8.4	8.1	8.5	8.4	na	na
Social	8.3	7.9	7.7	7.6	7.6	7.5	7.3	7.0	7.1	na	na
Engineering	17.0	16.2	16.8	17.4	18.6	19.7	20.4	21.2	21.3	na	na
	Doctorates										
	thousands										
Total	17.0	17.2	17.2	17.6	17.6	18.0	18.1	18.3	18.9	19.3	20.3
Sciences	14.6	14.8	14.7	15.1	15.0	15.2	15.2	15.2	15.5	15.6	16.1
Physical	2.6	2.7	2.5	2.6	2.7	2.8	2.8	2.9	3.1	3.2	3.3
Mathematics	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Computer	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5
Environmental	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7
Life	4.4	4.5	4.7	4.8	4.8	4.8	4.9	4.9	4.8	4.8	5.1
Psychology	3.1	3.1	3.1	3.4	3.2	3.3	3.3	3.1	3.1	3.2	3.1
Social	3.0	2.9	2.8	2.8	2.7	2.7	2.6	2.6	2.7	2.6	2.6
Engineering	2.4	2.5	2.5	2.5	2.6	2.8	2.9	3.2	3.4	3.7	4.2

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 2-12, p. 224, NSB 89-1, (Washington, DC: GPO, 1989).

Table 95.—Scientists and engineers employed in science and engineering jobs, by field, 1976-1988.

Field	1976	1978	1980	1982	1984	1986	1988
				thousands			
Total	2,122	2,364	2,543	2,867	3,465	3,920	4,616
Scientists	844	938	1,033	1,148	1,403	1,676	2,000
Physical scientists	155	168	166	211	234	265	287
Mathematical scientists	44	48	57	68	87	104	133
Computer specialists	116	117	197	216	340	437	552
Environmental scientists	47	57	63	83	90	97	98
Life scientists	198	228	267	298	294	341	381
Psychologists	104	107	113	106	152	173	229
Social scientists	181	158	170	166	206	260	321
Engineers	1,278	1,427	1,510	1,719	2,062	2,244	2,616
Astronautic/aeronautic	56	61	65	77	92	104	112
Chemical	76	82	89	101	128	132	132
Civil	183	205	217	244	293	319	311
Electrical & electronic	268	327	357	414	475	541	602
Mechanical	273	297	309	334	414	454	598
Other engineers	423	455	473	549	661	694	861

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 3-2, p. 240, NSB 89-1, (Washington, DC: GPO, 1989).

Notes: Detail may not add to total because of independent rounding. Total fields for 1988 were estimated on the 1988 science and engineering employment rate for that year.

Table 96.—Federal obligations for basic research, by science and engineering field, 1980-1989.

Field	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
	million constant 1982 $									
Total, all fields	5,516	5,409	5,482	6,006	6,532	7,010	7,116	7,564	7,905	8,150
Science, total	4,891	4,775	4,815	5,275	5,689	6,128	6,164	6,617	6,932	7,159
Physical	1,440	1,421	1,394	1,523	1,597	1,628	1,671	1,773	1,877	2,016
Mathematics	79	85	91	97	105	117	124	134	135	143
Computer	55	56	67	87	97	104	115	109	118	144
Environmental	616	572	520	557	607	627	654	661	709	748
Life	2,424	2,386	2,526	2,774	3,039	3,395	3,368	3,690	3,840	3,845
Psychology	99	98	90	89	100	119	116	124	124	128
Social	174	147	120	132	123	126	99	110	110	108
Other	4	10	7	16	21	12	17	16	19	27
Engineering	549	564	611	662	781	793	845	837	869	882

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 4-11, p. 281, NSB 89-1, (Washington, DC: GPO, 1989).

Notes: Detail may not add to total because of independent rounding. Data for 1988 and 1989 were estimated. Other includes sciences not elsewhere classified.

Table 97.—Federal obligations for applied research, by science and engineering field, 1980-1989.

Field	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
					million constant 1982 $					
Total	8,170	7,694	7,541	7,669	7,313	7,455	7,287	7,610	7,592	7,448
Science	5,377	4,962	4,766	4,955	4,744	5,004	4,869	5,143	5,106	4,962
Physical	920	961	1,107	1,251	1,147	1,104	1,008	978	905	917
Mathematics	28	41	37	31	34	48	37	39	39	39
Computer	97	74	104	119	101	147	149	143	141	144
Environmental	872	631	628	644	572	631	639	618	631	589
Life	2,523	2,373	2,220	2,194	2,171	2,310	2,274	2,520	2,575	2,448
Psychology	135	126	129	142	147	174	175	188	186	186
Social	444	387	266	285	281	286	264	296	290	284
Other	358	369	275	289	291	304	323	361	339	355
Engineering	2,791	2,731	2,776	2,713	2,569	2,451	2,418	2,467	2,484	2,483

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 4-12, p. 283, NSB 89-1, (Washington, DC: GPO, 1989).

Notes: Detail may not add to total because of independent rounding. Data for 1988 and 1989 were estimated. Other includes categories not elsewhere classified.

Table 98.—Expenditures for academic research and development, by field, 1976-1987.

Field	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	billion constant 1982 $											
Total	5.91	6.07	6.45	6.88	7.15	7.34	7.32	7.56	7.97	8.69	9.54	10.22
Science	5.23	5.32	5.61	5.90	6.13	6.31	6.29	6.49	6.84	7.42	8.10	8.62
Physical	0.60	0.63	0.69	0.77	0.80	0.82	0.82	0.86	0.92	1.03	1.12	1.17
Math.	0.07	0.08	0.08	0.10	0.09	0.09	0.10	0.10	0.12	0.12	0.13	0.15
Computer	0.07	0.08	0.09	0.13	0.13	0.14	0.15	0.17	0.21	0.25	0.28	0.31
Environ.	0.46	0.48	0.53	0.58	0.60	0.59	0.56	0.59	0.60	0.64	0.68	0.70
Life	3.33	3.37	3.54	3.64	3.80	3.96	4.02	4.13	4.36	4.73	5.14	5.48
Psychology	0.12	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.14	0.15	0.16
Social	0.42	0.40	0.39	0.38	0.40	0.40	0.36	0.33	0.34	0.35	0.40	0.42
Other	0.16	0.16	0.16	0.17	0.17	0.16	0.16	0.16	0.16	0.17	0.20	0.23
Engineering	0.68	0.74	0.84	0.99	1.02	1.04	1.03	1.08	1.13	1.27	1.43	1.60

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 5-9, p. 309, NSB 89-1, (Washington, DC: GPO, 1989).

Notes: Detail may not add to total because of independent rounding. Other includes sciences not elsewhere classified. Environmental sciences include atmospheric and earth sciences, oceanography, and other. Research and development in life sciences such as agricultural and biological sciences could be relevant to environmental sciences.

Table 99.—Doctoral scientists and engineers in academic research and development, by field, 1977-1987.

Field	1977	1979	1981	1983	1985	1987
			thousands			
Total, all fields	93.78	98.10	110.05	113.35	120.69	154.59
Scientists	83.93	87.37	99.41	100.28	107.54	135.53
Physical scientists	17.59	17.31	18.59	17.48	19.27	22.41
Mathematical scientists	6.84	6.78	6.79	7.15	6.84	9.17
Computer specialists	1.23	1.25	1.94	2.29	2.60	3.49
Environmental scientists	4.39	4.08	4.85	4.68	5.25	6.35
Life scientists	31.61	34.62	39.78	40.98	43.30	51.92
Psychologists	7.46	7.88	9.17	9.07	9.25	13.01
Social scientists	14.82	15.44	18.29	18.62	21.04	29.18
Engineers	9.85	10.73	10.63	13.06	13.15	19.06

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 5-17, p. 317, NSB 89-1, (Washington, DC: GPO, 1989).

Notes: Detail may not add to total because of independent rounding.

Table 100.—Doctoral scientists and engineers employed in basic research, by field and sector, 1977 and 1987.

Field	Total employed		Business and industry		4-year colleges & univ.		Hospitals and clinics		Nonprofit		Federal gov't	
	1977	1987	1977	1987	1977	1987	1977	1987	1977	1987	1977	1987
	thousands		%									
Total	88.3	133.3	10	9	75	79	2	1	4	4	8	7
Scientists	83.2	124.0	9	8	76	79	2	1	4	4	8	7
Physical	23.6	26.8	22	19	64	70	1	<1	4	4	8	7
Math.	6.3	8.4	3	1	93	95	(*)	(*)	1	0	2	2
Computer	0.8	2.8	20	25	71	68	(*)	(*)	3	4	3	2
Environ.	5.0	7.3	8	7	65	67	(*)	(*)	4	5	21	19
Life	31.8	49.2	4	6	77	77	3	2	4	5	9	9
Psych.	5.8	9.1	3	2	87	89	4	<1	1	2	3	3
Social	10.1	20.3	1	1	89	92	(*)	0	3	3	5	1
Engineers	5.1	9.4	25	19	63	70	(*)	(*)	3	3	8	8

Source: National Science Board, Science & Engineering Indicators, 1989, appendix table 5-19, p. 322, NSB 89-1, (Washington, DC: GPO, 1989).

Notes: (*) = fewer than 20 individuals. Detail does not round to 100 percent because percentage of total employed in other sectors is not included.

APPENDIX

The National Environmental Policy Act of 1969

(as Amended [1])

An Act to establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Environmental Policy Act of 1969."

Purpose

Sec. 2. The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

TITLE I
Declaration of National Environmental Policy

Sec. 101. (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

[1] Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, 4(b), Sept. 13, 1982.

(2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Sec. 102. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall—

(A) Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;

(B) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations;

(C) Include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

(i) The environmental impact of the proposed action,

(ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) Alternatives to the proposed action,

(iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes;

(D) Any detailed statement required under subparagraph (c) after January 1, 1970, for any major Federal action funded under a program of grants to States shall not be deemed to be legally insufficient solely by reason of having been prepared by a State agency or official, if:

(i) the State agency or official has statewide jurisdiction and has the responsibility for such action,

(ii) the responsible Federal official furnishes guidance and participates in such preparation,

(iii) the responsible Federal official independently evaluates such statement prior to its approval and adoption, and

(iv) after January 1, 1976, the responsible Federal official provides early notification to, and solicits the views of, any other State or any Federal land management entity of any action or any alternative thereto which may have significant impacts upon such State or affected Federal land management entity and, if there is any disagreement on such impacts, prepares a written assessment of such impacts and views for incorporation into such detailed statement.

The procedures in this subparagraph shall not relieve the Federal official of his responsibilities for the scope, objectivity, and content of the entire statement or of any other responsibility under this Act; and further, this subparagraph does not affect the legal sufficiency of statements prepared by State agencies with less than statewide jurisdiction.

(E) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(F) Recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend

appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment;

(G) Make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(H) Initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(I) Assist the Council on Environmental Quality established by title II of this Act.

Sec. 103. All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act and shall propose to the President not later than July 1, 1971, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this Act.

Sec. 104. Nothing in section 102 or 103 shall in any way affect the specific statutory obligations of any Federal agency (1) to comply with criteria or standards of environmental quality, (2) to coordinate or consult with any other Federal or State agency, or (3) to act, or refrain from acting contingent upon the recommendations or certification of any other Federal or State agency.

Sec. 105. The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

TITLE II
Council on Environmental Quality

Sec. 201. The President shall transmit to the Congress annually beginning July 1, 1970, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, manmade, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban and rural environment; (2) current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the Nation in the light of expected population pressures; (4) a review of the programs and activities (including regulatory activities) of the Federal Government, the State and local governments, and nongovernmental entities or individuals with particular reference to their effect on the environment and on the conservation, development and utilization of natural

resources; and (5) a program for remedying the deficiencies of existing programs and activities, together with recommendations for legislation.

Sec. 202. There is created in the Executive Office of the President a Council on Environmental Quality (hereinafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President to serve at his pleasure, by and with the advice and consent of the Senate. The President shall designate one of the members of the Council to serve as Chairman. Each member shall be a person who, as a result of his training, experience, and attainments, is exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in title I of this Act; to be conscious of and responsive to the scientific, economic, social, esthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment.

Sec. 203. (a) The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof).

(b) Notwithstanding section 1342 of Title 31, the Council may accept and employ voluntary and uncompensated services in furtherance of the purposes of the Council.

Sec. 204. It shall be the duty and function of the Council—

(1) to assist and advise the President in the preparation of the Environmental Quality Report required by section 201 of this title;

(2) to gather timely and authoritative information concerning the conditions and trends in the quality of the environment both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in title I of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social,

economic, health, and other requirements and goals of the Nation;

(5) to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality;

(6) to document and define changes in the natural environment, including the plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes;

(7) to report at least once each year to the President on the state and condition of the environment; and

(8) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

Sec. 205. In exercising its powers, functions, and duties under this Act, the Council shall—

(1) Consult with the Citizens' Advisory Committee on Environmental Quality established by Executive Order No. 11472, dated May 29, 1969, and with such representatives of science, industry, agriculture, labor, conservation organizations, State and local governments and other groups, as it deems advisable; and

(2) Utilize, to the fullest extent possible, the services, facilities and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided, thus assuring that the Council's activities will not unnecessarily overlap or conflict with similar activities authorized by law and performed by established agencies.

Sec. 206. Members of the Council shall serve full time and the Chairman of the Council shall be compensated at the rate provided for Level II of the Executive Schedule Pay Rates (5 U.S.C. 5313). The other members of the Council shall be compensated at the rate provided for Level IV of the Executive Schedule Pay Rates (5 U.S.C. 5315).

Sec. 207. The Council may accept reimbursements from any private nonprofit organization or from any department, agency, or instrumentality of the Federal Government, any State, or local government, for the reasonable travel expenses incurred by an officer or employee of the Council in connection with his attendance at any conference, seminar, or similar meeting conducted for the benefit of the Council.

Sec. 208. The Council may make expenditures in support of its international activities, including expenditures for: (1) international travel; (2) activities in implementation of international agreements; and (3) the support of international exchange programs in the United States and in foreign countries.

Sec. 209. There are authorized to be appropriated to carry out the provisions of this chapter not to exceed $300,000 for fiscal year 1970, $700,000 for fiscal year 1971, and $1,000,000 for each fiscal year thereafter.

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NEPA Regulations Citations

As of December 15, 1991, the following federal agencies had issued departmental orders or had published NEPA regulations in the *Code of Federal Regulations* (CFR) or the *Federal Register* (FR):

Agency	Citation
DEPARTMENT OF AGRICULTURE	7 CFR Part 3100; 7 CFR Part 1b
Agricultural Research Service	7 CFR Part 520
Agriculture Stabilization and Conservation Program Service	7 CFR Part 799
Animal and Plant Health Inspection Service	44 FR 50381 (1979)
Cooperative State Research Service	56 FR 8156 (1991) (to be published in final form)
Farmers Home Administration	7 CFR Parts 1901, 1940
Forest Service	36 CFR Part 219, FS Manual Chapter 1950
Soil Conservation Service	7 CFR Part 650
Rural Electrification Administration	7 CFR 1794; Dir. 17.02-2
DEPARTMENT OF COMMERCE	45 FR 47898 (1980)
Department of Administration	Order 216-6
Economic Development Administration	45 FR 63310 (1980), amended by 45 FR 4902 (1980); Dir. 17.02-2
National Oceanic and Atmospheric Administration (NOAA)	48 FR 14734 (1983); NOAA Directives Manual 2-10, Environmental Review Procedures, July 23, 1984
DEPARTMENT OF DEFENSE	32 CFR Part 214, 32 CFR Part 197
Department of the Air Force	32 CFR Part 989
Army Corps of Engineers	33 CFR Part 230, 32 CFR Chptr. II
Department of the Army	32 CFR Parts 650, 651
Department of the Navy	32 CFR Part 775
Defense Logistics Agency	DLA 1000.22
DEPARTMENT OF ENERGY	45 FR 20694 (1980), amended by 47 FR 7976 (1982), 48 FR 685 (1983), 52 FR 659 (1987), 52 FR 47662 (1987)
Coal Utilization Program	10 CFR Part 305

DEPARTMENT OF HEALTH AND HUMAN SERVICES (HHS)	HHS Gen. Adm. Manual; 45 FR 76519 (1980), amended by 47 FR 2414 (1982)
Food and Drug Administration	21 CFR Part 25
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	24 CFR Part 50, 51, 58
Housing and Community Development Act	24 CFR Part 50, 58
Community Development Block Grant Program	24 CFR 58
DEPARTMENT OF THE INTERIOR	516 Departmental Manual 1-7; 45 FR 27541 (1980), amended by 49 FR 21437 (1984)
Bureau of Indian Affairs	30 BIAM Supplement 1, NEPA Handbook; 46 FR 7490 (1981)
Bureau of Mines	516 WBM 1-5, Environmental Quality —National Environmental Policy Act of 1969 (March 29, 1990); 45 FR 85528 (1980)
Bureau of Land Management	H-1790-1; 46 FR 7492 (1981), amended by 48 FR 43731 (1983)
Fish and Wildlife Service	Service Administ. Manual, 30 AM 2-4; 45 FR 47941 (1980), amended by 47 FR 28841 (1982), 49 FR 7881 (1984)
Geological Survey	46 FR 7485 (1981)
Minerals Management Service	51 FR 1855 (1986)
National Park Service	NPS-12, NEPA Compliance Guideline; 46 FR 1042 (1981)
Office of Surface Mining, Reclamation and Control	OMRE NEPA Handbook on Procedures For Implementing the National Environmental Policy Act
Bureau of Reclamation	National Environmental Policy Act Handbook, October 1990; 45 FR 47944 (1980), amended by 48 FR 17151 (1983)
DEPARTMENT OF JUSTICE	28 CFR Part 61
Drug Enforcement Agency	28 CFR Part 61, Appendix B
Immigration and Naturalization Service	28 CFR Part 61, Appendix C
Bureau of Prisons	28 CFR Part 61, Appendix A
Office of Justice, Assistance, Research and Statistics	28 CFR Part 61, Appendix D

DEPARTMENT OF LABOR	29 CFR Part 11
DEPARTMENT OF STATE	22 CFR Part 161
DEPARTMENT OF THE TREASURY	45 FR 1828 (1980)
DEPARTMENT OF TRANSPORTATION	Order DOT 5610.1c; 44 FR 56420 (1979)
Coast Guard	Commandant Instruction M 16475.1B, July 12, 1985; 45 FR 32816 (1980), amended by 50 FR 32944 (1985)
Federal Aviation Administration	Order FAA 1050.1D (agency-wide order); FAA 5050.41, Airport Environmental Handbook, October 8, 1985 (applies to airport grant program only); 45 FR 2244 (1980), as amended by 49 FR 28501 (1984)
Federal Highway Administration	23 CFR Parts 650, 771
Federal Railroad Administration	Procedures For Considering Environmental Impacts; 45 FR 40854 (1980)
Maritime Administration	Maritime Administrative Order 600.1, July 23, 1985
National Highway Traffic Safety Administration	49 CFR Part 520
Saint Lawrence Seaway Development Corporation	Order SLS 10 5610.1C, May 26, 1981, 56 FR 28795 (1981)
Urban Mass Transportation Administration	23 CFR Part 771
	Copies of unpublished DOT procedures may be requested from: Environmental Division Room 9217 U.S. Department of Transportation Washington, DC 20590
DEPARTMENT OF VETERAN'S AFFAIRS	38 CFR Part 26
ADVISORY COUNCIL ON HISTORIC PRESERVATION	36 CFR Part 805
AGENCY FOR INTERNATIONAL DEVELOPMENT	22 CFR Part 216

ARMS CONTROL DISARMAMENT AGENCY	45 FR 69510 (1980)
CENTRAL INTELLIGENCE AGENCY	44 FR 45431 (1979)
COMMITTEE FOR PURCHASE FROM BLIND AND OTHER SEVERELY HANDICAPPED	41 CFR Part 51-6
CONSUMER PRODUCT SAFETY COMMISSION	16 CFR Part 1021
DELAWARE RIVER BASIN COMMISSION	18 CFR Part 401, subpart D
ENVIRONMENTAL PROTECTION AGENCY	40 CFR Part 6, Part 227
EXPORT-IMPORT BANK	12 CFR Part 408
FARM CREDIT ADMINISTRATION	12 CFR Chapter VI
FEDERAL COMMUNICATIONS COMMISSION	47 CFR Part I, subpart I
FEDERAL EMERGENCY MANAGEMENT AGENCY	44 CFR Part 10
FEDERAL ENERGY REGULATORY COMMISSION	18 CFR Part 2.80, Part 380
FEDERAL MARITIME COMMISSION	46 CFR Part 504
FEDERAL TRADE COMMISSION	16 CFR Part 1, Subpart I
GENERAL SERVICES ADMINISTRATION	PBS P 1095.4B, Preparation of Environmental Assessments and Environmental Impact Statements; 50 FR 7648 (1985)
INTERNATIONAL BOUNDARY AND WATER COMMISSION	46 FR 44083 (1981)

INTERNATIONAL COMMUNICATION AGENCY	44 FR 45489 (1979)
INTERSTATE COMMERCE COMMISSION	49 CFR Part 1105, amended by 54 FR 9822 (1989)
MARINE MAMMAL COMMISSION	50 CFR Part 530
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)	14 CFR Part 1204, 1216
NATIONAL CAPITAL PLANNING COMMISSION	44 FR 64923 (1979); Manual of Environmental Policies and Procedures
NATIONAL INSTITUTES OF HEALTH	Gen. Adm. Manual, 30-10
NATIONAL SCIENCE FOUNDATION	45 CFR Part 640
NUCLEAR REGULATORY COMMISSION	10 CFR Part 51
OVERSEAS PRIVATE INVESTMENT CORPORATION	44 FR 51385 (1979); Foreign Assistance Act, §§ 231, 237m, 239g
PENNSYLVANIA AVENUE DEVELOPMENT CORPORATION	36 CFR Part 907
SECURITIES AND EXCHANGE COMMISSION	17 CFR Part 200, subpart K
SMALL BUSINESS ADMINISTRATION	45 FR 7358 (1980)
TENNESSEE VALLEY AUTHORITY	Procedures For Compliance With The National Environmental Policy Act, April 12, 1983; 45 FR 54511 (1980), amended by 47 FR 54586 (1982), 48 FR 19264 (1983)
UNITED STATES POSTAL SERVICE	39 CFR Part 775
WATER RESOURCES COUNCIL	18 CFR Part 707

States with Environmental Policy Acts

Sixteen states, the District of Columbia, and Puerto Rico have environmental policy acts or "little NEPAs."

State	Citation
Arkansas	Ark. Stat. Ann. §8-1-101 (1987)
California	Cal. Pub. Res. Code §§21000 et seq. (West 1982)
Connecticut	Conn. Gen. Stat. Ann. §§22a-14 to 22a-20 (West Supp. 1974-75)
District of Columbia	D.C. Code Ann. 1981 §6-981 et seq.
Florida	Fla. Stat. §§380.92 et seq.
Hawaii	Hawaii Rev. Stat. §§343-1 to 343-8 (1985)
Indiana	Ind. Code Ann. §§13-1-10-1 to 13-1-10-8 (West 1987)
Maryland	Md. Nat. Res. Code Ann. §§1-301 to 1-305 (1983 and Supp. 1987)
Massachusetts	Mass. Gen. Laws Ann. ch. 30, §§61-62H
Minnesota	Minn. Stat. Ann. §§116D.01 et seq. (West 1977 and Supp. 1981)
Montana	Mont. Code Ann. §§75-1-101 to -105; §75-1-201 (1981)
New York	N.Y. Envtl. Conserv. Law §§8-0101 to 8-0117 (McKinney 1984)
North Carolina	N.C. Gen. Stat. §§113A-1 to 10 (1978)
Puerto Rico	P.R. Laws Ann. tit. 12, §§1121-1127
South Dakota	S.D. Codified Laws Ann. §§34A-9-1 to 34A-9-12
Virginia	Va. Code §§10.1-1200 through 10.1-1212 (Subject to redefinition by the Virginia General Assembly in 1992)
Washington	Wash. Rev. Code §§43.21C.010-43.21C.910 (1974); Wash. Admin. Code R. 197-11
Wisconsin	Wis. Stat. §1.11 et seq.; Department of Natural Resources WEPA rules are found in Wis. Admin. Code NR 150.01-40

States with Limited Environmental Review Requirements Established by Statute, Executive Order, or Other Administrative Directives

Eighteen states and the District of Columbia have limited environmental review requirements established by statute, executive order, or other administrative directives.

State	Requirement
Arizona	An Executive Order mandates that the Governor's Commission on Arizona Environment evaluate environmental problems, make recommendations to the Governor, and establish a clearinghouse for the exchange of information relating to environmental problems and their solutions.
Arkansas	In addition to a "little NEPA," Ark. Code Ann. §15-41-108 provides that the Arkansas Game and Fish Commission must prepare an EIS for cutting timber on Commission land.
California	In addition to a "little NEPA," the following California Codes require environmental impact reports: Cal. Food & Agric. Code §33487(new construction or repairs of dairy farms) Cal. Gov. Code §7075 (establishment of enterprise zones) Cal. Gov. Code §7087.5 (initial study and notice of preparation under Employment and Economic Incentive Act) Cal. Gov. Code §51119 (timberland production zones; exemption) Cal. Gov. Code §65950.1 (extension of time for EIR for planning and zoning of development projects) Cal. Health & Safety Code §33333.3 (preparation and adoption of community redevelopment plans) Cal. Health & Safety Code §56040 (implementation and administration for large scale urban development) Cal. Pub. Res. Code §6873.2 (oil and gas leases on tide and submerged lands and beds of navigable rivers and lakes) Cal. Pub. Res. Code §25540.4 (power facility and site certification) Cal. Pub. Res. Code §30718 (implementation of port development under California Coastal Act)

	Cal. Str. & H. Code §199.9 (mass transit guideway system) Cal. Water Code §13389 (applicability of EISs to Clean Water Act)
Delaware	In the Del. Code Ann. tit. 7, Chapter 66 concerns wetlands permits, and Chapter 20, coastal zone permits.
District of Columbia	In addition to a "little NEPA," D.C. Code Ann. §43-1903 involves public utility environmental impact statements.
Georgia	The Code of Georgia provides that on certain types of actions on a case by case basis, the state may require that an environmental assessment be prepared; EAs would be reviewed by the state Department of Natural Resources, Environmental Protection Division.
Louisiana	La. Rev. Stat. Ann. §30:2021 (West 1991) covers interstate compacts on environmental control, for which the Louisiana Department of Environmental Quality serves as a clearinghouse for all statements of environmental impact to be prepared or reviewed by state agencies (other than Department of Transportation and Development), in accordance with NEPA. The Department of Wildlife and Fisheries is responsible for review and comment on any EIS regarding fish and wildlife resources or their habitat, as well as the discharge of dredge and fill material into state waters. The Department of Health and Human Resources is responsible for EISs regarding public health.
Massachusetts	In addition to a "little NEPA," Mass. Gen. Laws Ann. ch. 111H, §30 concern low-level radioactive waste facility licensing.
Michigan	Executive Order 1974-4 requires each state agency to prepare a formal environmental assessment for all major activities of the agency having a possible significant impact on the environment or human life. Mich. Comp. Laws Ann. §281.655 et seq. covers EISs for sand dune mining and model zoning plans under the Lakes and Rivers Sand Dune Protection and Management Act.

New Jersey	Executive Order No. 53 (1973) requires all state agencies and departments to submit to the Department of Environmental Protection a description of the environmental impact of all major construction projects. N.J. Rev. Stat. §13:19-7 provides for EISs for such projects as coastal protection, N.J. Rev. Stat. §27:23-23.5 covers EISs for the New Jersey Turnpike authority (highways and turnpikes). N.J. Rev. Stat. 52:13F-4 refers to environmental impact statements on specific legislative bills.
North Carolina	In addition to a "little NEPA," N.C. Gen. Stat. §104G-11 concerns low-level radioactive waste management technology licensing.
North Dakota	N.D. Century Code §§54-01-05.4 provides that the Governor may require EISs of a limited nature prior to the transfer of any interest in state-owned land to federal agencies.
Oregon	Although Oregon Rev. Stat. ch. 46 does not require EISs for major actions having a significant impact on the environment, permit applications for siting of major energy generating facilities must include a background report addressing various anticipated environmental impacts.
Pennsylvania	Executive Order requires Environmental Assessments for all transportation projects. Various state regulations require EAs for other state actions.
Rhode Island	R.I. Gen. Laws §23-63-3 provides that a facility which plans to export tires for burning must submit an EIS conforming to the EPA standards.
South Dakota	In addition to a "little NEPA," S.D. Codified laws Ann. §49-41B-21 et seq. concern energy conversion and transmission facilities.
Utah	State of Utah Exec. Order (Aug. 27, 1974)
Washington	In addition to a "little NEPA," Wash. Rev. Code Ann. §78.52.125 (oil and gas conservation drilling that affects surface waters)

	Wash Rev. Code Ann. 70.95.700 (solid waste incineration or energy recovery facility)
Wisconsin	In addition to a "little NEPA," Wis. Stat. Ann. §144.68 (solid waste, hazardous waste, and refuse)

Selected Federal Officials with Environment-Related Duties

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
Environmental policy and agency coordination

Michael R. Deland
Chairman
Council on Environmental Quality
722 Jackson Place, NW
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DEPARTMENT OF AGRICULTURE
Forestry, soil conservation, research, and wilderness areas

Edward Madigan
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Department of Agriculture
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Washington, DC 20250

James Moseley
Assistant Secretary for Natural Resources and Environment
Department of Agriculture
12th & Jefferson Drive, SW
Washington, DC 20250

DEPARTMENT OF COMMERCE
Oceanic and atmospheric monitoring and research, management of living marine resources, coastal zone and marine sanctuary management, marine pollution, response and damage assessment; technology and export promotion

Barbara Franklin
Secretary of Commerce
14th & Constitution Avenue, NW
Washington, DC 20230

John A. Knauss
Under Secretary and Administrator
National Oceanic and Atmospheric Administration
14th & Constitution Avenue, NW
Washington, DC 20230

Robert M. White
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Department of Commerce
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DEPARTMENT OF DEFENSE
Civil works construction, dredge and fill permits, pollution control and resource management at Defense facilities

Dick Cheney
Secretary of Defense
The Pentagon
Washington, DC 20301-1000

Thomas E. Baca
Deputy Assistant Secretary of Defense for the Environment
Department of Defense
The Pentagon
Washington, DC 20301-8000

Lieutenant General Henry J. Hatch
Commanding General
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20 Massachusetts Avenue, NW
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Energy policy coordination, research and development

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Secretary of Energy
1000 Independence Avenue, SW
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Washington, DC 20585

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public and environmental health-related concerns

Louis W. Sullivan, M.D.
Secretary of Health and Human Services
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DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Housing, urban parks, urban planning

Jack F. Kemp
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DEPARTMENT OF THE INTERIOR
National parks, national wildlife refuges, Bureau of Land Management, public lands, American Indian trust lands, water resources, fish and wildlife, Outer Continental Shelf, Exclusive Economic Zone, energy and minerals, mined land reclamation, mine health and safety research, and natural hazards, geological survey

Manuel Lujan
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David C. O'Neal
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Department of the Interior
1849 C Street, NW
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John M. Sayre
Assistant Secretary for
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Department of the Interior
1849 C Street, NW
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DEPARTMENT OF JUSTICE
Environmental law and litigation

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Assistant Attorney General
Environment and Natural
Resources Division
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Washington, DC 20530

DEPARTMENT OF LABOR
Occupational health

Lynn M. Martin
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200 Constitution Avenue, NW
Washington, DC 20210

DEPARTMENT OF STATE
International environmental
negotiations and treaties.

James A. Baker
Secretary of State
2201 C Street, NW
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Curtis E. U. Bohlen
Assistant Secretary for Oceans and
International Environmental and
Scientific Affairs (OES)
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DEPARTMENT OF TRANSPORTATION
Mass transit, roads, airplane
noise, oil pollution, hazardous materials transport

Andrew H. Card
Secretary of Transportation
400 Seventh Street, SW
Washington, DC 20590

Admiral J. William Kime
Commandant
United States Coast Guard
2100 2nd Street, SW
Washington, DC 20590

DEPARTMENT OF THE TREASURY
Tax and economic policy,
multilateral banking, trade and environment

Nicholas F. Brady
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1500 Pennsylvania Avenue, NW
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DEPARTMENT OF VETERANS AFFAIRS
Hospitals and veterans' health

Edward J. Derwinski
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810 Vermont Avenue, NW
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ENVIRONMENTAL PROTECTION AGENCY
Air and water pollution, solid and hazardous waste, radiation, pesticides, noise, toxic substances, health, and environmental education

William K. Reilly
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GENERAL SERVICES ADMINISTRATION
Federal buildings, vehicle fleets, procurement of supplies

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Atmospheric and space science research and coordination

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NATIONAL SCIENCE FOUNDATION
Science research funding and coordination

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NUCLEAR REGULATORY COMMISSION
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Nuclear Regulatory Commission
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SMITHSONIAN INSTITUTION
Environmental education, historical preservation, and research

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TENNESSEE VALLEY AUTHORITY
Electric power generation and water resource management

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U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
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UNITED STATES INFORMATION AGENCY
Overseas information and cultural programs, Voice of America

Henry E. Catto
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United States Information Agency
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Federal Documents for Further Reading

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FORESTRY

HAZARDOUS & SOLID WASTES

INTERNATIONAL ISSUES

MISSION TO PLANET EARTH

NATIONAL ENVIRONMENTAL POLICY ACT

POLLUTION PREVENTION

PRIVATE SECTOR INITIATIVES

PUBLIC LANDS

TECHNOLOGY

TRANSPORTATION

WATER

WETLANDS

DATA & TRENDS

APPENDIX

The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization,industrial expansion, research exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

National Environmental Policy Act of 1969, section 101 (a)